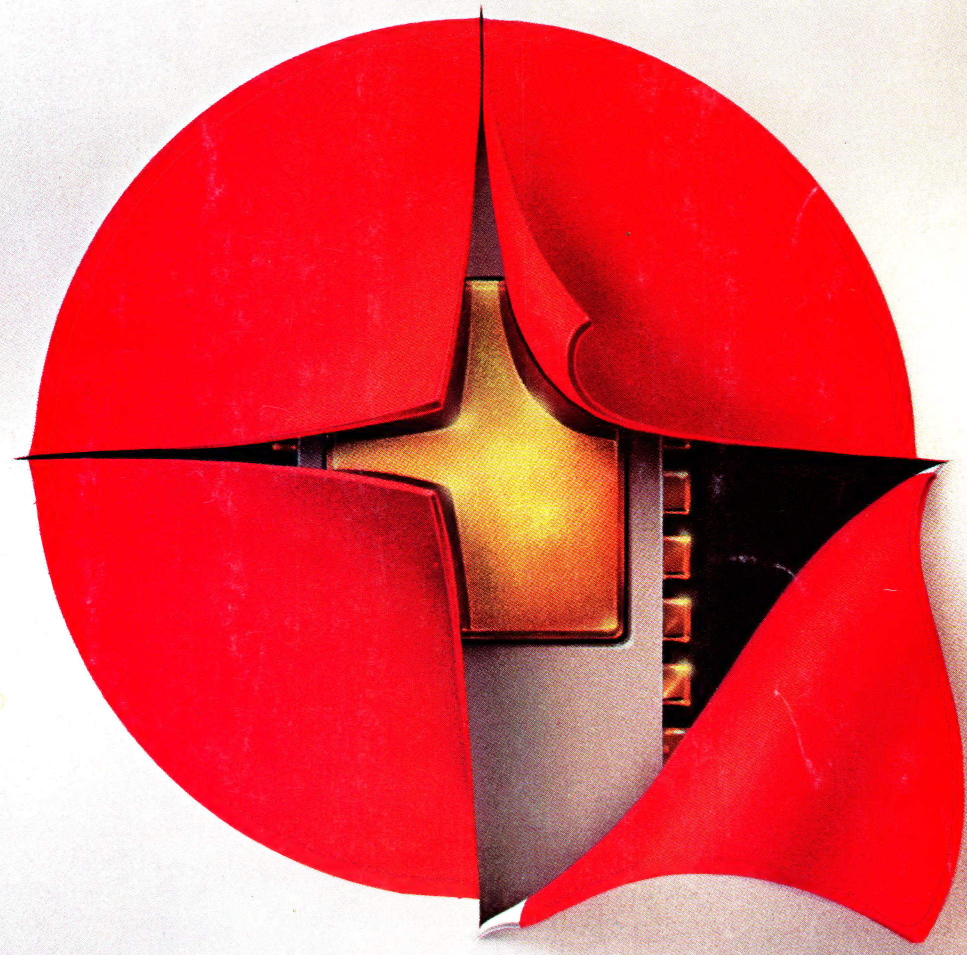
A McGRAW-HILL ELECTRONICS PUBLICATION MARCH 4, 1985 $3

ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

INSIDE JAPAN'S NEW MICRO DESIGNS

19 MAR REC'D

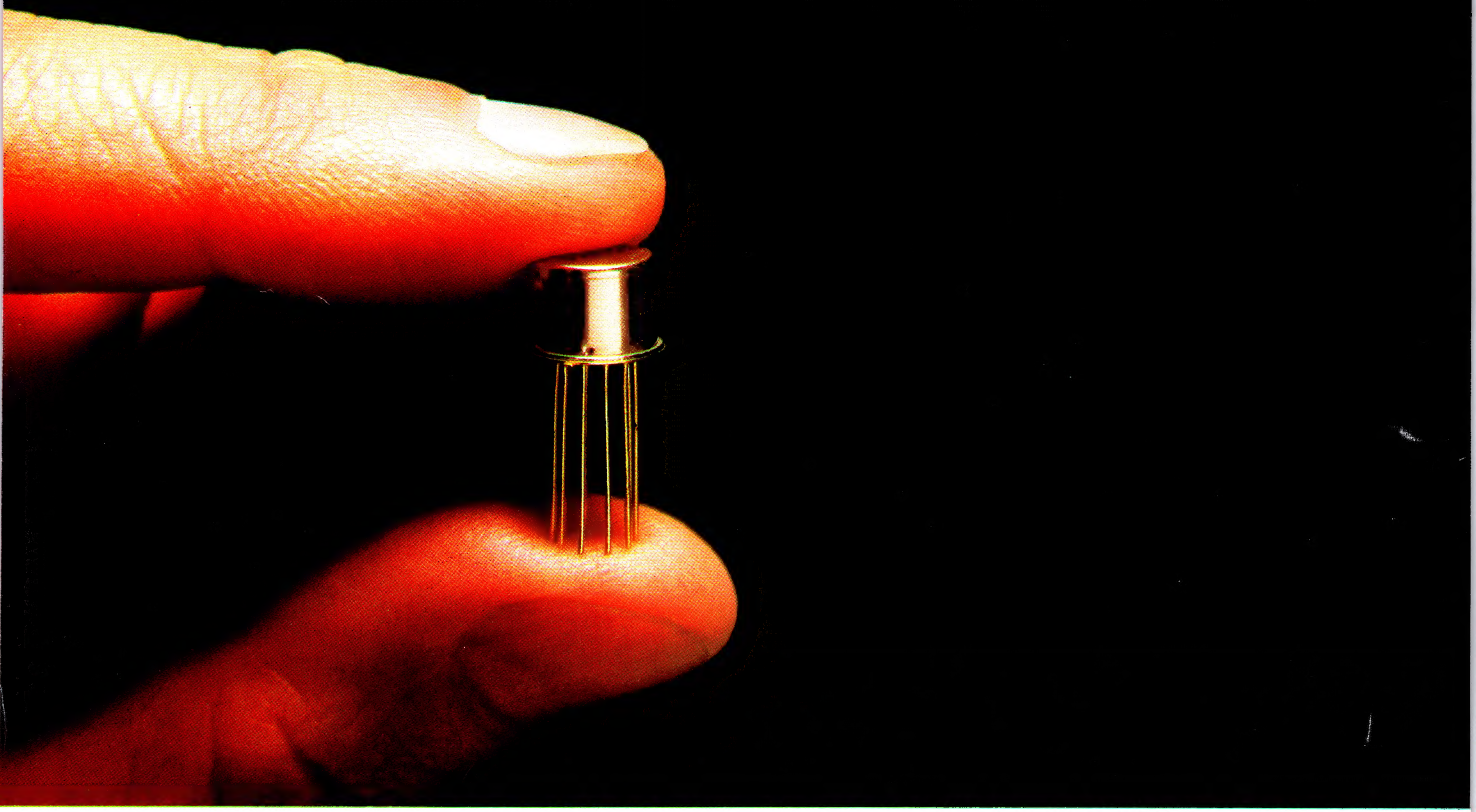


CONTROVERSY GROWS
PAGE 18

Is the ROM market dead or just waiting for a rebirth?/34

Unix is poised for marriage to mainstream computing/47

Maglatch TO-5. The world's smallest relay with indestructible memory.



Our little magnetic latching TO-5 relay simply never forgets. Once it's set with a short pulse of coil voltage, Teledyne's Maglatch TO-5 will retain its state until reset. Even if system power fails or is shut off.

Because holding power is not required, the Maglatch TO-5 uses less energy than any other relay you can buy. This makes it ideal for any situation where power drain is critical. And its tiny footprint makes it ideal for high density printed circuit boards.

For RF switching applications, the Maglatch's low intercontact capacitance and contact circuit losses provide high isolation and low insertion loss up through UHF.

The Maglatch TO-5 is available in SPDT and DPDT styles. And it comes in commercial/industrial versions as well as military versions qualified to "L," "M," and "P" levels of MIL-R-39016.

Teledyne is an industry leader. We have been for over twenty years.

We've used our technical and manufacturing know-how to create the world's best subminiature electromechanical and solid state relays.

If you'd like complete technical information about our Maglatch TO-5 relay, or applications assistance, please call or write today. We're here to help you.

TELEDYNE RELAYS
The best little relays in the world.

12525 Daphne Ave., Hawthorne, California 90250 • (213) 777-0077
U.K. Sales Office: Heathrow House, Bath Rd., Cranford, Hounslow, Middlesex, TW 5 9QQ • 01-897-2501
European Hqtrs: Abraham Lincoln Strasse 38-42 • 62 Wiesbaden, W. Germany 06121-7680
Japan Sales Office: Nihon, Seimei Akasaka Building • 8-1-19 Akasaka, Minato-Ku Tokyo, 107 Japan (03) 403-8141

Circle 900 on reader service card

ROCKWELL SEMICONDUCTOR TECHNOLOGY CREATES THE NEXT GENERATION OF INTEGRAL MODEMS.

Our third-generation VLSI capabilities give you support at any level.

Building modems into your product line used to be a complicated and costly process. But Rockwell International's latest generation of VLSI integral modems is changing all that.

Today, our VLSI capabilities mean that we can support your design requirements at any level: you can order VLSI chip sets; standard cards with all data rates interchangeable; or custom cards designed to fit your specific shape, connector and software integration requirements.

In fact, we can offer a simple, economical solution to virtually any application requirement from 1200 to 9600 bps. Since our modems include both a microprocessor bus and an RS232C interface, they can be easily designed into computers, from micros to mainframes; plus G2-G3 facsimile machines, multiplexers, terminals and, of course, box modems.

What's more, Rockwell is the only supplier of full-duplex, dial 2400 bps VLSI integral modems.

And all of our modems are as reliable as they are versatile. Based on our customers' experience with over a half million Rockwell integral modems in use around the world, we've been able to document an MTBF of 200,000 hours—nearly 23 years between service calls. Performance-wise, transmission is virtually error-free over unconditioned or dial-up phone lines because our integral modems offer auto-adaptive equalization.

We are the world's largest supplier of high-speed modem subsystems and devices. Ask your sales representative or distributor for a quote today, and you'll see that we have a distinct advantage in price and delivery lead times, too.

Rockwell integral modems. A generation ahead of all the rest.

Rockwell Semiconductor
Products Division
Rockwell International, P.O. Box C,
MS 501-300, Newport Beach, CA
92660. Call toll free (800) 854-8099.
In California: (800) 422-4230.

Rockwell International

...where science gets down to business

Circle 1 on reader service card

ElectronicsWeek

International edition

PREVIEWS

EDITOR IN CHIEF: George R. Davis

EXECUTIVE EDITOR, *technical:* Samuel Weber
EXECUTIVE EDITOR, *news:* Arthur Erikson
MANAGING EDITOR: Howard Wolff

SENIOR EDITORS:
Howard Bierman, Ray Connolly,
Tom Manuel, Kevin Smith, Jeremy Young

ART DIRECTOR: Fred Sklenar

DEPARTMENTS
Business: Robert J. Kozma
Communications & Microwave: Terry Feldt
Components: Michael B. Rand
Computers & Peripherals: Tom Manuel
Government/Military: Ray Connolly
Industrial & Consumer: David M. Weber
New Products: Steve Zollo, Tobias Naegele
Packaging & Production: Jerry Lyman
Semiconductors: Samuel Weber
Software & Microsystems: Alexander Wolfe
Systems Integration: Robert Rosenberg
Test & Measurement: Howard Bierman

NEWS EDITORS
John F. King, Robert J. Kozma,
Jesse J. Leaf, David M. Weber

ARTICLES EDITOR
Charles J. Wohl

EDITORIAL PRODUCTION
Charles D. Ciatto, *Manager,* June Noto,
Jody LoGrasso, Kevin J. Powers

COPY DESK
Susan Levi Wallach, *Chief,* Jay J. Iorio,
Bill McIlvaine, Jim Taibi, Sherrie Van Tyle

ART DEPARTMENT
Sachiko Inagaki, *Associate Director*
Kathleen Mulderrig, Annamaria Palma,
Art Assistants

NEWS BUREAUS
Boston: Craig D. Rose
Chicago: Wesley R. Iversen
Dallas: J. Robert Lineback
Los Angeles: Larry Waller
New York: George Leopold
Palo Alto: Clifford Barney, Eve Bennett, Denise Caruso
Washington: Ray Connolly, Karen Berney
Frankfurt: John Gosch
London: Kevin Smith
Paris: Robert T. Gallagher
Tokyo: Charles L. Cohen, Michael Berger

ADMINISTRATIVE ASSISTANT: Kathleen Morgan
EDITORIAL ASSISTANT: Ann Jacobs
EDITORIAL SECRETARIES: Laura Aspery,
Ina Gruber, Josephine Ortiz

PUBLISHER: Laurence Altman

Next ElectronicsWeek

The military wants reliability designed in

The Department of Defense is worried about the high cost and long hours that must be invested in keeping its electronic systems working. It's easy to understand why: the Pentagon allots 25% of its budget to preventive maintenance, and the figure could go higher with the growing complexity of weapons systems. Next week, an *ElectronicsWeek* special report by Jerry Lyman describes how the Pentagon is working with its vendors to improve both the reliability and maintainability of advanced systems.

Europeans race calendar to establish DBS standard

Broadcast and government officials agree that direct satellite broadcasting on the continent should be based on a system of multiplexed analog components, known as MAC. But unless the remaining issues are settled quickly, the hopes of TV set manufacturers for a receiver standard common to all countries will go out the window. MAC eliminates many of the drawbacks that hamper composite signals, but there are several contending MAC versions. In fact, one of the biggest controversies is whether the one that can also handle cable broadcasting should be selected. Examine the pros and cons and the background implications in Robert Gallagher's report from Paris.

Looking ahead in ElectronicsWeek

Environmental, work-safety issues plague chip makers

Making semiconductor wafers entails the use of some of the most toxic chemicals known, and citizens as well as environmental agencies are beginning to view the industry as a threat to its surroundings. For a discussion of the issues and what industry, government, and public-interest groups are doing about them, see an upcoming *ElectronicsWeek* special report.

March 4, 1985 Volume 58, Number 9
95,256 copies of this issue printed

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation, and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: M C G R A W H I L L N E W Y O R K.

Subscriptions limited to professional persons with active responsibility in electronics technology. No subscriptions accepted without complete identification of subscriber name, title or job function, company or organization, and product manufactured or services performed. Based on information supplied, the publisher reserves the right to reject nonqualified requests. Subscription rates: the United States and possessions $32 one year, $55 two years, $76 three years; company addressed and company libraries $40 one year, $67 two years, $93 three years; Canada and Mexico $34 one year, $57 two years, $78 three years; Europe $50 one year, $85 two years, $125 three years; Japan, Israel, and Brazil $85 one year, $140 two years, $200 three years; Australia and New Zealand $95 one year, $170 two years, $240 three years, including air freight; all other countries $50 one year, $85 two years, $125 three years. Limited quota of subscriptions available at higher-than-basic rate for persons allied to field served. Check with publisher for these rates. Single copies: $3.00. Please allow four to eight weeks for shipment.

Officers of McGraw-Hill Information Systems Company: President: Richard B. Miller; Executive Vice Presidents: Frederick P. Jannot, Construction Information Group; Russell C. White, Computers and Communications Information Group; J. Thomas Ryan, Marketing and International. Senior Vice Presidents: Francis A. Shinal, Controller; Robert C. Violette, Manufacturing and Technology. Senior Vice Presidents and Publishers: Harry L. Brown, Computers and Communications; David J. McGrath, Construction. Group Vice President: Peter B. McCuen, Communications. Vice Presidents: Fred O. Jensen, Planning and Development; Margaret L. Dagner, Human Resources.

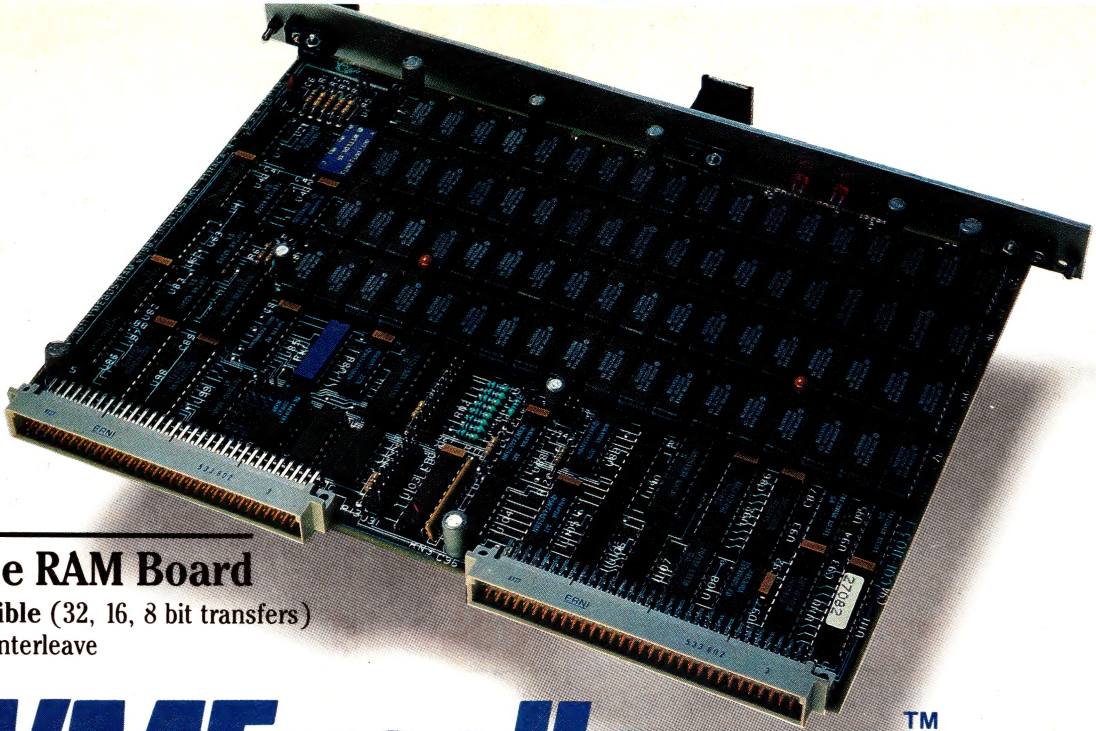
Officers of the Corporation: Harold W. McGraw Jr., Chairman; Joseph L. Dionne, President and Chief Executive Officer; Robert N. Landes, Executive Vice President and Secretary; Ralph J. Webb, Vice President and Treasurer. Donald L. Fruehling, Executive Vice President, Publishing Operations Group; Ralph R. Schulz, Senior Vice President, Editorial; Walter D. Serwatka, Senior Vice President, Manufacturing and Circulation Services. Vice Presidents: Shel F. Asen, Manufacturing; George R. Elsinger, Circulation.

Title registered in U. S. Patent Office; Copyright 1984 by McGraw-Hill Inc. All rights reserved. The contents of this publication may not be reproduced in whole or in part without the consent of copyright owner.

Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC), 21 Congress Street, Salem, Mass. 01970, to photocopy any article herein for the base fee of $0.50 per copy of the article plus $0.25 per page. Payment should be sent directly to the CCC. Copying done for other than personal or internal reference use without the express permission of McGraw-Hill is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. ISSN 0748-3252/85 $0.50+.25.

Subscribers: The publisher, upon written request to our New York office from any subscriber, agrees to refund that part of the subscription price applying to copies not yet mailed. Please send change-of-address notices or complaints to Fulfillment Manager; subscription orders to Circulation Manager, ElectronicsWeek, at address below. Change-of-address notices should provide old as well as new address, including zip codes. Attach address label from recent issue. Allow one month for change to become effective. Subscriber Service: call (201) 356-7980, 9 a.m. to 4 p.m. EST. Postmaster: Please send Address Changes to Fulfillment Manager, ElectronicsWeek, CN 808, Martinsville, N. J. 08836.

Editorial department phones: Administration (212) 512-2645, News and New Products (212) 512-2685, Technology (212) 512-2666. Bureaus: Boston (617) 262-1160, Chicago (312) 751-3811, Dallas (214) 458-2400, Los Angeles (213) 480-5234, New York (212) 512-2975, San Francisco/Palo Alto (415) 968-2712, Washington (202) 463-1650, Frankfurt 72-5566, London 493-1451, Paris 720-2070, Tokyo 581-9816. **Business departments:** (212) 512-3469 (Business departments follow the Advertisers' Index).

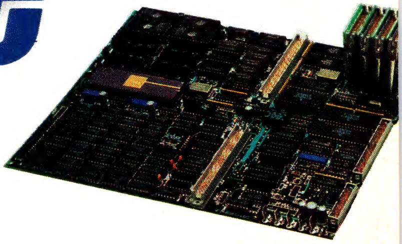


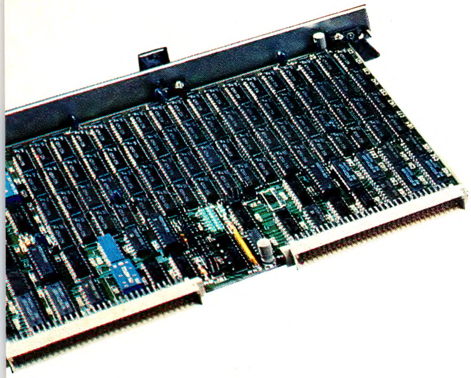
IV-1611

2 Megabyte RAM Board

- **68020 compatible** (32, 16, 8 bit transfers)
- 4-way internal interleave

VMExcellence™





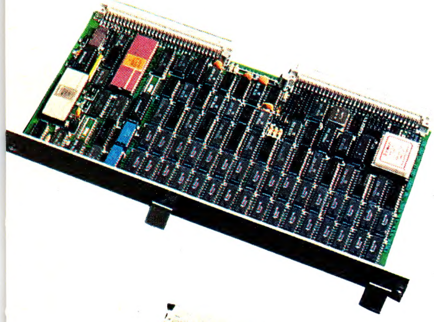
VMEbus

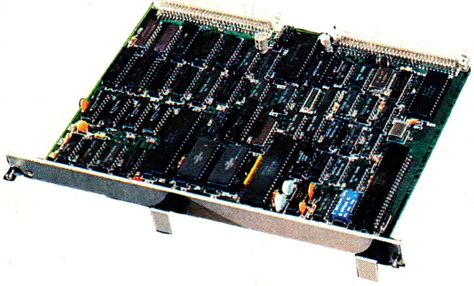
*UNIX System V**

High Resolution Color Graphics

Ironics VMEbus boards, systems, and software provide the OEM and Systems Integrator with a powerful and productive development environment, a high performance, cost effective target environment, and the tools and technical support to put it all together... *from IRONICS, the price/performance leader in VMEbus.*

*Trademark AT&T Bell Laboratories.





IRONICS Incorporated

Computer Systems Division
742 Cascadilla Street
Ithaca, N.Y. 14850
607-277-4060 Telex: 705-742

Circle 3 on reader service card

A McGRAW-HILL ELECTRONICS PUBLICATION

ElectronicsWeek

THE VOICE OF THE INDUSTRY, HEARD EVERY MONDAY

EXCLUSIVE COVERAGE

Unix update/47
Special products analysis/59

Technology Around the World

Personal Computers Kaypro eyes PC clone war. With IBM mired under a large backlog of orders for its new PC AT, at least one competitor has marched a look-alike to the market. Others could follow. **16**

Microprocessor Architectures Sun rises on new designs. Change is in the wind for Japan's microprocessor makers as strict U.S. copyright laws force a move to native architectures and aggressive mainstream marketing **18**

Wafer Processing Bellcore researchers levitate wafers. Bell Communications Research engineers have created a method to move wafers pneumatically through the complete growing process using gas jets **24**

Consumer Electronics Europe goes cashless with electronic funds transfers. Denmark could be the first to establish a nationwide EFT network **25**

Semiconductors British GaAs chips go to market. Three UK semiconductor houses are readying pilot-production lines for GaAs chips **28**

Industrial Electronics High-tech leg irons put to the test. In the future, nonviolent criminals may be kept at home, shackled by transmitter-equipped rubberized legbands **30**

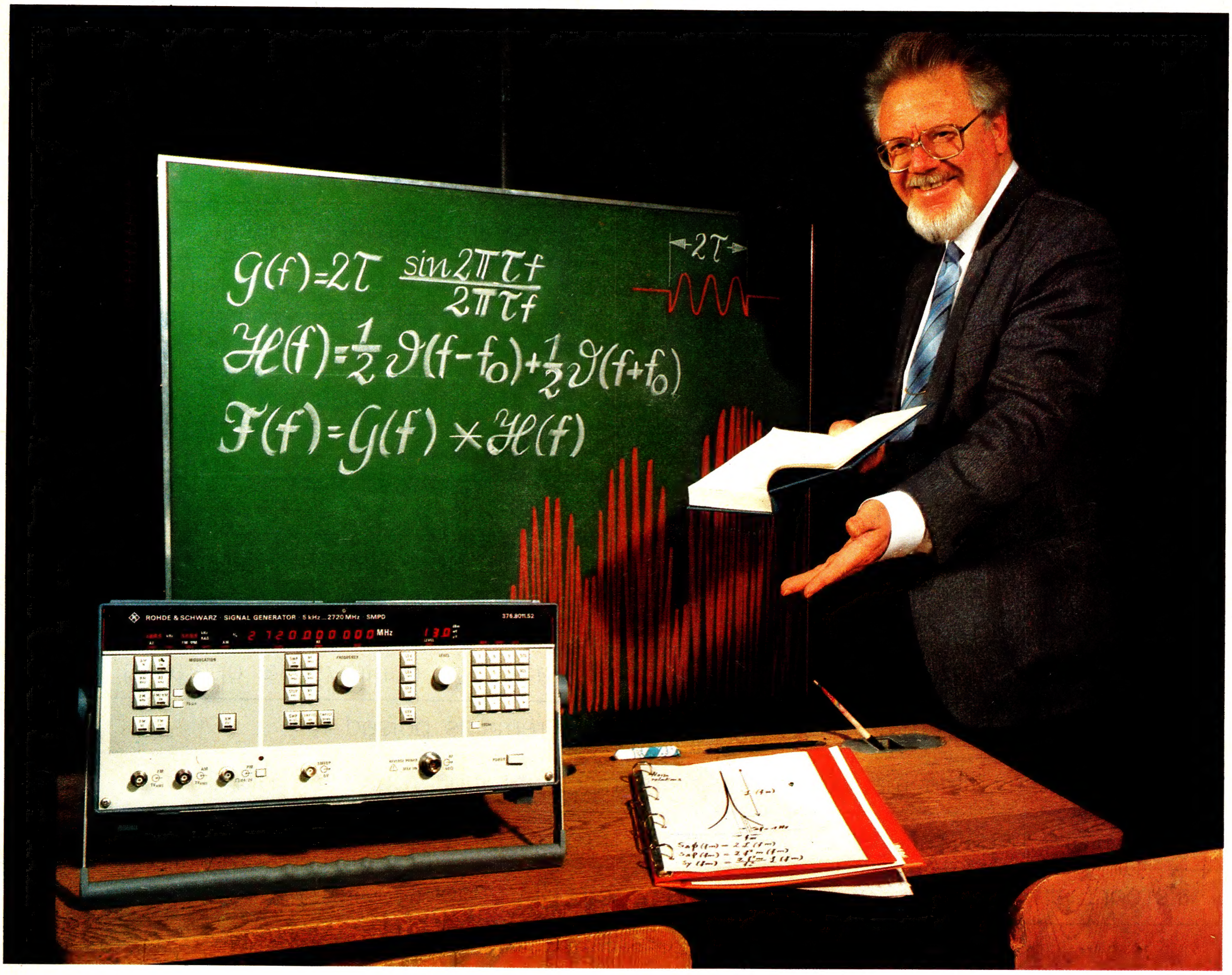
Photovoltaics New materials cut solar-cell cost. The classic pn junction is abandoned in favor of a metal-insulator-semiconductor technique **31**

Software Speed counts most for Ada compilers. Gould Inc. goes with a high-performance unit even though it hasn't been validated **32**

Computers Toshiba, Shiina in Sord play. Sord has been looking for a savior for months. Last week, Toshiba came to the rescue **32**

(continued on p. 6)

Signal Generator SMPD second to none



Best in its class from 5 kHz to 2.72 GHz

SMPD receives top marks whatever the test, e.g. in CEPT-based measurements on transceivers where it functions as an interference source up to 2.72 GHz, in the development of telemetry and telecommunication systems and in all sorts of general lab applications. Optional high-speed pulse modulation also means the testing of radar receivers under real conditions.

- Frequency range 5 kHz to 2.72 GHz
- Output level −143 to 13 dBm
- Highly linear φM and FM with wide deviations (e.g. max. deviation of 3.2 MHz at carrier frequencies ≥ 1.36 GHz) and precise AM over its entire frequency range
- Pulse modulation with rise and fall times of less than 10 ns and an on/off ratio of 80 dB, also simultaneously with AM and φM/FM
- IEC 625-1 and IEEE 488 remote control
- Spectrally pure signals for measurements on oscillators and out-of-band measurements on transceivers
- Reliable attenuator for system applications with more than 10 million guaranteed operations

The SMPC Signal Generator is the "little brother" of the SMPD with the same specifications up to 1.36 GHz.

Ask for the detailed data sheets **SMPD** and **SMPC**

Rohde & Schwarz GmbH & Co. KG
Postfach 80 14 69
D-8000 Muenchen 80
Federal Republic of Germany
Telex 523 703 (rus d)
Tel. internat. + (49 89) 41 29-0

There are **R & S agencies** in 80 countries. We plan and supply stationary and mobile systems, also on a turn-key basis. **R & S services** comprise installation, maintenance, calibration, training and documentation.

ROHDE & SCHWARZ

Circle 91 on reader service card

1 SMD E 015

VOLUME 58, NO. 9 MARCH 4, 1985

ElectronicsWeek

Memories Mask ROM rides again. Some three years after their market nearly collapsed, ROM makers around the world see renewed growth with megabit-density chips, new pinout schemes, and much higher speeds **34**

People Keiske Yawata starts LSI Logic affiliate. Theodore Smith of FileNet sells a whole new product. TI's Kevin McDonough **40**

Companies Olivetti picks up Britain's fallen Acorn **44**

Special Technology Reports

Operating Systems Unix update: coming of age. The controversial operating system that programmers love and users hate remains poised for its long-awaited marriage to mainstream computing around the world **47**

Software Legal defenses against piracy. Protection in the U.S. is confusing at best and impossible at worst. But understanding some basic rules of the road can pay off for authors and companies **53**

New Products

Special Report: Unix gets office-friendly. *ElectronicsWeek*'s exclusive product-news roundup examines the promise and realities of today's Unix offerings as the system moves out of the labs and onto desks **59**

Microsystems Newcomer rides the VMEbus **61**

Communications Multiplexers transmit data, voice, and video cheaply **69**

Network Testers Network-management system uses graphics to speed repair **72**

Features

Departments Previews **2** Meetings **9** Up Front **13** ElectronicsWeek Index **39**

New Literature **81** Editorial **84**

HARRIS SPECTRUM

Who offers the largest family of high-speed monolithic op amps?

Bipolar or JFET. High slew rate or wideband. Fast settling or low noise. Whatever your application, Harris has the right high-speed operational amplifier to get the job done.

Harris offers "The First Family" of high-speed monolithic op amps—13 models in singles, duals and quads with slew rates up to 600 V/μs, unity gain stability at 40 MHz, gain bandwidth products up to 600 MHz and settling times down to 70 ns.

So you get fast, reliable performance for data acquistion, pulse and video amplifiers, audio amps and filters, comparators and integrators.

They're great for precision signal generation, D/A converters, coaxial cable drivers, instrumentation amplifiers, precision threshold detectors and radio frequency devices.

Harris monolithic high-speed op amps: your first choice for the most applications.

Harris High-Speed Monolithic Op Amps

P/N	Nature	Slew Rate (V/μs)	Gain Bandwidth Product (MHz)	Settling Time (ns)	Noise Voltage (nV/$\sqrt{Hz}$)	Output Current (mA)	Closed Loop, Min. Gain Stable
HA-2620	Single		100				5
HA-2520	Single	120		200		20	3
HA-5160	Single (J-FET)	120	100	300			10
HA-5190	Single	200	150	70	15	30	5
HA-2541	Single Unity Gain Stable	300	40	80			1
HA-2542	Single (Power)	350	60			100	2
HA-2540	Single	400	400		15		10
HA-2539	Single	600	600		15		10
HA-OP37	Single (Low Noise)		60		3		5
HA-5147	Single (Low Noise)	35	120		3		10
HA-5112	Dual (Low Noise)	20	60		4.3		10
HA-5114	Quad (Low Noise)	20	60		4.3		10
LM 118/318	Single	70	15	300			1

Contact: Harris Systems Ltd., European Semiconductor Operations, Eskdale Road, Winnersh Workingham, Berkshire, RG11 5TR, England

Harris Semiconductor: Analog - Bipolar Digital - CMOS Digital - Gallium Arsenide - Semicustom - Custom

HARRIS

For your information, our name is Harris.

Circle 88 on reader service card

“Philips’ 16 MHz transparent emulation will win you tomorrow’s game today!”

“An unbeatable team: Philips’ Engineering & Development System with transparent real-time emulation of over 30 μP’s and the 68000/68010 MAB emulating at a record-breaking 16 MHz. Thanks to Philips TOP technology. Top technology that’s put the emulation memory right next to the processor. For shorter lines and faster access. Your leading edge in tomorrow’s systems game! If you want to gain the lead, then come to Philips. The company to offer you total 68000 support: emulators, boards, chips, compilers and operating systems.

Make Philips your leading edge in tomorrow’s systems game.

Contact your local Philips Test and Measurement Office or write to:

Philips S&I, T&M Dept.,
TQ III-4-62
5600 MD Eindhoven, The Netherlands.
Germany 0561-50 10 (Mr. J. Lichte)
Great Britain 0223-35 88 66 (Mr. R. Giles)
France 01-830 11 11 (Mr. A. Bassargette)
Italy 039-3 63 51 (Mr. C. Beardo)
The Netherlands 040-78 32 38 (Mr. K. Bakker)
Sweden 08-782 10 78 (Mr. R. Andemark).”

PHILIPS **Test & Measuring Instruments**

Circle 92 on reader service card

PHILIPS

Meetings

33rd National Relay Conference, National Association of Relay Manufacturers and School of Electrical and Computer Engineering at Oklahoma State University (Dan D. Lingelbach, School of Electrical and Computer Engineering, Oklahoma State University, Stillwater, Okla. 74078), Oklahoma State University, Stillwater, April 22-24.

Principles and Applications of Drive Systems—Hydraulic and Electric, National Fluid Power Association (Ellen Kendall, National Fluid Power Association, 3333 N. Mayfair Rd., Milwaukee, Wis. 53222), Milwaukee School of Engineering, Milwaukee, April 24-26.

Expert Systems and Knowledge Engineering, Gottlieb Duttweiler Institute (T. Bernold, Gottlieb Duttweiler Institute, CH-8803 Ruschlikon/Zurich, Switzerland), Gottlieb Duttweiler Institute, Ruschlikon/Zurich, April 25-26.

16th Pittsburgh Conference on Modeling and Simulation, University of Pittsburgh School of Engineering, *et al.* (William G. Vogt, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh, Pa. 15261), University of Pittsburgh, April 25-26.

Workshop on Analytical Simulation Modeling of IEEE 802.4 Token Bus, National Bureau of Standards (Robert Rosenthal, B226 Technology Building, NBS, Gaithersburg, Md. 20899), NBS Administration Building, Gaithersburg, April 29-30.

CAD/CAM Databases: Who's in Control?, CAD/CAM Alert (Jacquelin Cooper, CAD/CAM Alert, 824 Boylston St., Chestnut Hill, Mass. 02167), Cathedral Hill Hotel, San Francisco, April 29-30.

Association for Information and Image Management Annual Conference and Exposition, AIIM (1100 Wayne Ave., Silver Spring, Md. 20910), Washington Convention Center, Washington, April 29-May 2.

Electric Production Efficiency Exposition '85, Network Events Ltd. (Network Events Ltd., Printers Mews, Market Hill, Buckingham, MK18 1JX, UK), National Exhibition Centre, Birmingham, England, April 30-May 2.

1985 Artificial Intelligence and Advanced Computer Technology Conference and Exhibition, DM Data Inc. (6900 E. Camelback Rd., Suite 1000, Scottsdale, Ariz. 85251), Long Beach Convention Center, Long Beach, Calif., April 30-May 2.

1985 Society for Information Display International Symposium, Society for Information Display (James N. Price, Naval Ocean Systems Center, Code 7113, San Diego, Calif. 92152), Sheraton Twin Towers, Orlando, Fla., April 30-May 2.

National Online Meeting, *Online Review* (Learned Information Inc. 143 Old Marlton Pike, Medford, N.J. 08055), Sheraton Centre, New York, April 30-May 2.

16th Reliability Symposium, IEEE and American Society for Quality Control (Marie Trethaway, EMC Technology, 1971 Old Cuthbert Rd., Cherry Hill, N.J. 08034), Marriott Hotel, Bala-Cynwyd, Pa., May 1.

Marine Technology Symposium, Marine Technology Society (Frank Wilem, Triton Systems Inc., 109 E. Scenic Dr., Pass Christian, Miss. 39571), International Hotel, New Orleans, May 1-3.

Seminars

World Class Manufacturing for VLSI, University of California at Irvine School of Engineering and University Extension (Maria Norris, University of California Extension, P.O. Box AZ, Irvine, Calif. 92716), Emerald Anaheim Hotel, Anaheim, Calif., April 23-25.

New Generation PBX—The Path to Voice/Data Integration, Data-Tech Institute (Lakeview Plaza, P.O. Box 2429, Clifton, N.J. 07015), Holiday Inn Somerset, Somerset/New Brunswick, N.J., April 24-26.

Selected Applications

Select Devices

Field Effect Transistors
Aerospace
Military
Medical

Crystalonics made FETs commercially available in 1960 and is still the leader in the field. We offer an array of excellent special devices, including:

- Low frequency, silicon, N-Channel, junction FETs (CM860/2N6550) with an ultra low input noise figure of $1.4\ nV/\sqrt{Hz}$ typical at 1 kHz, for low frequency amplifier applications.
- RF FET for radio frequency amplifier applications (CP640/CP643), broad band, with wide dynamic range, through 500 MHz.
- A series of switching FETs (2N4445/2N5432) with under 15 ohms ON resistance. Standard types with R_{ON} as low as 2½ ohms (2N6568), and specials as low as 1 ohm (CM856).
- FOTOFETS®, light-sensitive, junction FETs in transistor cases with curved or flat glass lenses. Ideal for optical coupling applications demanding supersensitivity, fast response, low dark current and stability.

For further information send for our short form catalog.

TELEDYNE
CRYSTALONICS
147 Sherman Street
Cambridge, MA 02140
Tel: (617) 491-1670 • TWX 710-320-1196

Circle 9 on reader service card

There's more to the picture than

EHRENSTRÅHLE & CO

AGEMA INFRARED SYSTEMS – THE NEW NAME FOR – AGA INFRARED SYSTEMS AB, AGATRONICS LTD, AGA SYSTÈMES INFRAROUGES S.A.R.L., AGA ITALIA SRL, AGA INFRARED SYSTEMS LTD, AGA CORPORA

meets the eye.

THE EYE IS A FANTASTIC INSTRUMENT, but not a very dependable one when it comes to detecting things as they really are. It registers only a limited range of colors and shapes.

Of the vast quantity of infrared radiation that constantly surrounds us it sees nothing. Which is too bad, because infrared radiation could tell us a lot about hot and cold bodies – which undoubtedly would help us avoid making any number of mistakes.

Who should know that better than we? Our heat sensitive cameras have helped people see through things for more than 20 years. During that entire time, we've worked under the name AGA. But now some changes have been made.

No, not in our products. They're still as high quality as ever. And not in our personnel. They are just as competent as ever. Perhaps some other company has surged to the forefront? No, that's not it either. We're still out in front – and we plan to stay there for many more years. What then has changed? Nothing but our name. As of March first, 1985, we'll be using the name AGEMA Infrared Systems. A minute change in a big world – perhaps, but an important one for us.

You'll find our thermal cameras wherever you go – in industry, being used for monitoring production and processes, and in hospitals, R&D laboratories, and nuclear power stations. Our range of products extends from inexpensive, simple systems to the most advanced, sophisticated available anywhere: Thermovision. It won't be long before many other applications are found for infrared technology. Because, when it comes to infrared, there's a lot to look into. Just use your imagination.

Now the question of what the Trojans would have done with that gift horse if they'd had more insight. Naturally nobody would have been taken in. And the world would be one good story poorer. So, it was probably all for the best.

AGEMA
Infrared Systems

We know the importance of seeing through.

HEADQUARTERS: AGEMA INFRARED SYSTEMS AB,
BOX 3, S-182 11 DANDERYD, SWEDEN.
TEL. 08-753 34 00.

Circle 11 on reader service card

PTRONIK GMBH.

We offer you a switch-mode voltage regulator module off the shelf.

The GS-R400 is a complete family of high current, high voltage switching mode regulators in step down configuration.

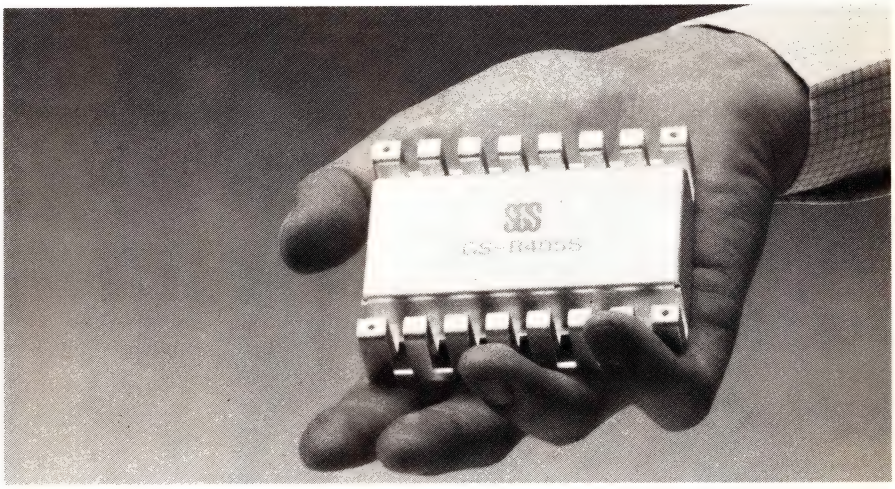
But more importantly, it's got the specification you'd design in yourself if you had the time.

The GS-R400 has been especially designed for economical industrial and professional applications, in on-board and decentralised power supply systems.

So whatever application you have in mind, the GS-R400 is sure to fit in with your plans.

What's more, while your latest system may still be on the drawing board, the GS-R is available right now.

Just call your local SGS office or distributor for high technology off the shelf.



GS-R400. Features.

- HIGH INPUT VOLTAGE (48V max)
- HIGH OUTPUT CURRENT (4A)
- HIGH EFFICIENCY (up to 90%)
- PC-CARD OR CHASSIS MOUNTABLE
- NO EXTERNAL COMPONENTS REQUIRED
- RESET OUTPUT
- SOFT START
- REMOTE INHIBIT/ENABLE
- REMOTE OUTPUT VOLTAGE SENSE
- SHORT CIRCUIT PROTECTION (NON LATCHING)
- THERMAL PROTECTION
- CROWBAR PROTECTION FOR THE LOAD

GS-R400. The family.

TYPE	INPUT VOLTAGE V	OUTPUT VOLTAGE V	OUTPUT CURRENT A	CURRENT LIMIT A	AVG SHORT CIRCUIT CURRENT – A	SWITCHING FREQ. kHz	LINE REGULATION dB	LOAD REGULATION mV/A	TEMP. STABILITY mV/°C	INHIBIT VOLTAGE V	RESET OUTPUT	CROWBAR INTERVENTION V	MAX. CASE TEMP. °C	OUTPUT NOISE mV	EFFICIENCY
GS-R405	8-48	5	4	5	0,5	100	60	20	0,2	5	No	6	75	25	75
GS-R405S	8-48	5	4	5	0,5	100	60	20	0,2	5	Yes	6	75	25	75
GS-R412	15-48	12	4	5	0,5	100	60	40	0,5	5	No	15	75	30	85
GS-R415	18-48	15	4	5	0,5	100	60	60	0,6	5	No	18	75	40	90
GS-R424	27-48	24	4	5	0,5	100	60	90	1	5	No	29	75	50	90
GS-R400V	V_0+3-48	5-40 ADJUST.	4	5	0,5	100	60	20/90	0,2/1,6	5	No	1,2V_0	75	25/50	75/90

INTERNATIONAL HEADQUARTERS
SGS-ATES Componenti Elettronici SpA. Via C. Olivetti, 2. 20041 Agrate Brianza. Tel: 039-65551 Tlx: 330131-330141
Benelux B-1180 Bruxelles. Winston Churchill Avenue, 122 Tel: 02-3432439 Tlx: 24149B · **Brazil** 05413 Sao Paulo. Avenue Henrique Schaumann 286-CJ33 Tel: 11-853 5062 Tlx: 37988 UMBR BR · **Denmark** 2730 Herlev. Herlev Torv, 4 Tel: 02-948533 Tlx: 35411 · **Eastern Europe** Export Sales Office 20090 Assago (MI). V. le Milanofiori, Strada 4, Palazzo A/4/A Tel: 2-8244131 Telex: 330131 SGSAGR · **France** 92120 Montrouge. 21-23 rue de la Vanne Tel: 1-6571133 Tlx: 250938 F · **West Germany** 8018 Grafing bei München. Haidling 17 Tel: 08092-690 Tlx: 05-27378 · **Hong Kong** 9th Floor, Block N, Kaiser Estate, Phase III. 11, Hok Yuen St. Hung Hom, Kowloon Tel: 3-644251/5 Tlx: 33906 ESGIES HX Tel: 02-4695651 · **Italy** 20090 Assago (MI). V. le Milanofiori, Strada 4, Palazzo A/4/A Tel: 2-8244131 Tlx: 330131 SGSAGR · **Singapore** Singapore 1231. Lorong, 4 & 6, Toa Payoh Tel: 2531411 Tlx: ESGIES RS 21412 · **Sweden** 19500 Märsta. Bristagatan 16 Tel: 0760-40120 Tlx: 042-10932 · **Switzerland** 6340 Baar. Oberneuhofstrasse 2 Tel: 042-315955 Tlx: 864915 · **UK** Planar House, Walton Street, Aylesbury, Bucks. Tel: 0296-5977 Tlx: 041-83245 · **USA** Phoenix AZ 85022. 1000 East Bell Road Tel: 602 867 6245 Tlx: SGS ATES 249976

SGS®
Technology and Service

Circle 12 on reader service card

NSF BOOSTS SUPERCOMPUTER INDUSTRY

New vistas of research yielding substantial commercial payoffs should open up to academic scientists and engineers under a $200 million National Science Foundation grant to establish four national centers for research and development using supercomputers. "The role of high-speed computation is becoming increasingly important in the U.S. economy," stressed Kenneth G. Wilson, Nobel prize winner and Cornell University professor, when the NSF announced last week that Cornell was among the recipients. The centers will help U.S. firms shorten the product-design cycle and manage competition with their foreign rivals, he predicted. The other centers selected from among 22 applicants are the University of Illinois at Champaign-Urbana and two consortiums—one managed by 12 universities near Princeton, N.J., and known as the John von Neumann Center, and a group of 18 universities, based at the University of California at San Diego. The four will receive annual grants of between $7 million and $13 million for five years. State and local governments have promised to at least match the NSF awards with money or resources.

Two of the centers are slated to get supercomputers made by Cray Research Inc. San Diego will get Cray's $17 million XMP-48, which stores 8 million words and runs at about 1 billion floating-point operations per second with four processors. Illinois will receive the less powerful two-processor version but plans to upgrade quickly to the XMP-48. The Princeton center is holding out for ETA Systems Inc.'s 10-gigaflops multiprocessor machine, promised for delivery in 1987. Meanwhile, it will use a Cyber 205 from Control Data Corp.

The most unusual configuration is going to Cornell University. Wilson, director of the university's new Center for Theory and Simulation in Science and Engineering, selected an IBM Corp. 3084-QX mainframe connected to four Floating Point Systems Inc. 264 processors. "We are already using an IBM 3081-K and FPS-164 design for research and want to stay with a good thing," he noted, adding that, "I want to be working with IBM when it makes a real commitment to the needs of the scientific and engineering community." IBM will eventually be forced into the supercomputer business if it wants to retain and expand its research-oriented customer base, Wilson believes.

Having different types of supercomputers installed in each center should advance knowledge, leading to the design of more efficient supercomputers, predicts Larry Smarr, director of the Illinois facility. "We have an unprecedented opportunity to study these machines and find out which problems run best on different parallel architectures." The supercomputing industry will also benefit from the software library that each center plans to build up, he notes. "We expect to do all the software research ourselves but will pass it on to vendors for commercial production and distribution."

Plans call for all the centers to be linked by a national transmission network by 1989. AT&T, Vitalink Communications, and Bolt, Beranek & Newman are among the firms competing for the separate $5 million NSF award to begin research on the network this year. "Users are asking for a constant interactive graphics capability that will require transmission speeds in the megabaud range," reports John Connolly, director of the NSF's Office of Advanced Scientific Computing. □

Layoffs mount as soft sales hit chip suppliers harder. . .

The semiconductor industry's "inventory adjustment" period is painfully becoming a workforce-reduction stretch for hard-pressed chip makers. Last week, Micron Technology Inc. said it would furlough 625 employees—half its entire staff. Micron blames the move on severe price pressures in markets for dynamic random-access memories. Ironically, Micron was the first to push prices on 64-K DRAMs below the $2 mark [*ElectronicsWeek,* Oct. 8, 1984, p. 23]. Texas Instruments Inc. has sounded its most dismal note yet on the health of chip markets: it will extend reduced work schedules at some component operations until June 30. Seeq Technology Corp. is cutting its workforce by 15%, to 523, and its plants will be shut down for the first 10 days of March. Seeq continues to see cancellations of orders for commodity ultraviolet-erasable programmable read-only memories. Intel Corp., which is laying off 900 workers, expects first-quarter revenues to be as much as 15% below 1984's final period, when it had sales of $416 million. ☐

. . . while silicon-wafer suppliers feel the chill

The semiconductor slump is beginning to exact a toll in the silicon-wafer business as well. Wacker Siltronic Corp., one of the top three wafer suppliers, said last week that it plans to shut down operations for a week in late March, affecting 835 workers. "And there's at least a 50-50 chance of a second week's shutdown in April," says executive vice president Malcolm J. Russ. The move follows similar action by wafer supplier Siltec Corp., which is in the midst of a two-week shutdown at three plants, affecting 600 employees. Both firms say business began softening in November and has since gotten worse. Monsanto Electronic Materials Co., the No. 1 wafer supplier, has seen a similar trend in 3- and 4-in. wafers, with business off 25% from last year's second half. But sales of 5- and 6-in. wafers are holding up, it says. ☐

AT&T's LAN gets shot in the arm from IEEE committee

On its third attempt, the 1-Mb-baseband task force of the IEEE's 802.3 committee has won approval to develop its twisted-pair, carrier-sense multiple-access/collision-detection protocol as a full IEEE standard. The protocol is the basis for StarLan, AT&T's unannounced low-cost office local network [*ElectronicsWeek,* July 30, 1984, p. 11]. Twice rebuffed last year as not technically or economically ready for implementation as a standard, the protocol won overwhelming acceptance at the committee's February meeting. One observer said the lopsided vote (31-1 on technical issues) was due to "major contributions" from AT&T in providing data on crosstalk and electromagnetic interference. However, AT&T reportedly has delayed StarLan's announcement because of difficulties with presentation- and application-layer software compatibility. The same problem is also said to be causing delays in the shipment of IBM Corp.'s PC Net, a 2-Mb broadband LAN. ☐

Intel sues NEC over 8086 design infringement

Intel Corp. has filed a suit claiming that NEC Corp. has infringed on its copyright of the 8086 chip. Asking for an injunction against shipments of NEC's V-20 chip (see p. 18) and dollar damages, Intel states in the suit that 257 of the V-20's 302 starting instructions are exactly the same as those for Intel's 8086 chip. ☐

The Quantitative Solution to Automatic Systems Test.

Product performance and profitability both increase with the use of high throughput, high reliability test instruments. And only the Data 6000 Universal Waveform Analyzer combines the speed and dependability your operation requires with full analysis capabilities. The Data 6000 digitizes, stores, displays and analyzes data in one compact, easy-to-operate, versatile instrument. One that's equally at home in the R&D lab and on the production floor. Nothing else even comes close to the Data 6000 which offers you:

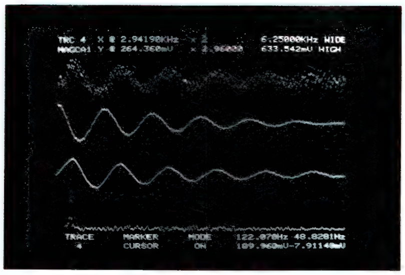
Precise Waveform Measurement

No matter how short-lived or complex the event, you'll capture it with *high resolution*, thanks to the Data 6000's plug-in digitizers which provide 100KHz, 14-bit; 36MHz, 12-bit; and 100MHz, 8-bit data acquisition capability. Sampling periods as fast as 10nS provided by the Model 620 plug-in, give you the accuracy and speed you need to acquisition even the fastest transient events. Intermediate Sampling Rates as required in production test of computer disk testing, power supply testing, acoustic emission tests, and video bandwidth measurements are provided by the Model 630's selectable conversion modes. This new plug-in provides an unprecedented 10-bit resolution at sampling rates to 18MHz, and 9- or 12-bit resolution at the maximum 36MHz sampling rate. And that's only the front end of the Data 6000's power!

Flexible Waveform Storage

Up to 50,000 points of data may be stored on on-board storage memory, with non-volatile expansion available on accessory floppy disk or your mass storage media. Data acquisition memory captures up to 50,000 points in a single acquisition (with the 610 and 611 plug-ins; up to 32,000 points for the Model 620; and up to 16,000 points with the Model 630 plug-in).

IEEE-488 RS-232


TRC 4 X @ 2.94190KHz x 2 6.25000KHz WIDE
MAGDA1 Y @ 264.360mU x 1.96000 633.542mU HIGH
TRACE 4
MARKER CURSOR
MODE ON
122.070Hz 48.8281Hz
109.960mU-7.91140mU

For system test applications the fully programmable Data 6000 can acquire waveforms, measure time domain waveforms with over 40 pre-programmed scalar measurements, compute and measure spectra, and transfer the resultant measurements or data points to your computer. In the above figure the Data 6000 performs summation averaging on a noisy signal, convolves the result with a user defined filter, and displays the FFT of the processed waveform on trace four.

6000 Series Plug-In's

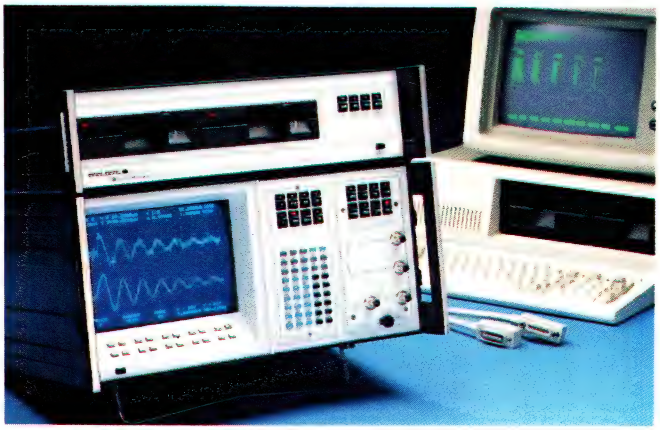
Model 610
100KHz, 14-bit
2-channel

Model 611
100KHz, 14-bit
4-channel

Model 620
100MHz, 8-bit
2-channel

Model 630
36MHz, 12-bit
2-channel

The Data 6000
Universal Waveform Analyzer



An Unbeatable Team

That's what you get when you interface the Data 6000 with your IEEE-488 or RS-232-C compatible host computer. This combination offers you:

Dynamic Control. Program all front panel controls remotely from the host computer. Send "user prompting" messages to the Data 6000's screen from the controller or program routine for test set, on-site instruction during the test routine. And for even greater control, you can also program user interactive feedback during testing simply by redefining the Data 6000's soft keys.

Fast Data Transfer. Here's where the Data 6000 goes beyond the rest. The bi-directional interfaces can easily transfer the measured and calculated results of tests directly to your controller. There is no need to develop a different software waveform analysis library for the controller itself. Additionally, the Data 6000 communicates the measured results or data points at speeds of up to 9600 baud on RS-232-C; standard transfer on IEEE-488 in ASCII real or scientific formats, and up to 400Kbytes/sec. on IEEE-488 in binary format with the Data 6000's High Speed Data Transfer option.

Easy Interfacing. The Data 6000 teams up with most host computers and controllers such as the DEC PDP-11 series; COMPAQ; IBM PC; HP-85, 87, 9816, 9826, 9836, 9845, 1000; Apple II; DEC PRO 350; GRID; Fluke, and many of the most popular minis and micros. **The result: automatic systems test that promotes your operation to a higher level of productivity and profitability.**

Team up with the Data 6000 now. For the winning edge in automatic systems test. **For more information, call: 800-343-8150. Or in Massachusetts, call 800-892-0528.**

Maintaining the Integrity of Measurement

The Data 6000 shown at left with a popular minicomputer; the IBM PC.

ANALOGIC®

DATA PRECISION®

Headquarters: Data Precision Division of Analogic Corporation, Electronics Avenue, Danvers, MA 01923 617-246-1600 Telex 6817144
ANALOGIC LTD, The Center, Weybridge, Surrey, England, KT138BN. Tel: 0932-56011. Telex: 928030 ANALOG G
ANALOGIC GMBH/DATA PRECISION, Daimlerring 2, 6200 Wiesbaden-Nordenstadt, W. Germany. Tel: 06122-4071. Telex: 4182587 ANA D

Circle 93 for Additional Information

Circle 15 for Demonstration

AROUND THE WORLD

KAYPRO EYES PC CLONE WAR II

Seeking to profit from IBM's hefty backlog, Kaypro Corp. leads in the race to market a compatible version of the popular PC AT ☐ *by Tom Manuel*

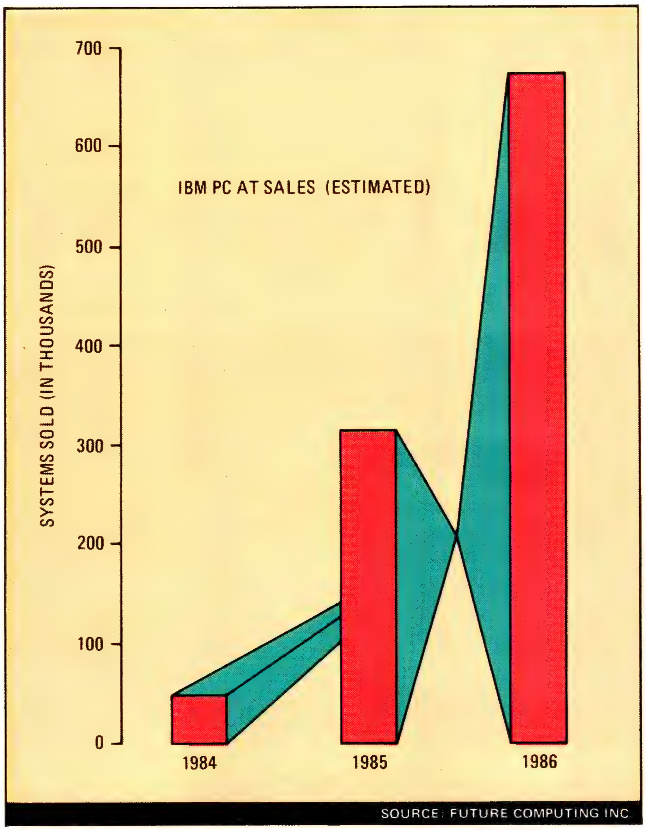
At the height of last August's sweltering heat, IBM Corp. made its competitors in the personal computer market sweat a little more by introducing the Personal Computer AT. As with the IBM PC, the company was soon flooded with orders for the powerful machine and a backlog developed.

Deliveries are now pushed back as far as September, say some observers. With IBM unable to keep up with demand for its new machine, the PC AT clones are coming to market.

The first one surfaced last week when Kaypro Corp. introduced its 286i computer. Like the AT, the 286i is based on Intel Corp.'s fast and highly integrated 80286 microprocessor. There are other 286-based computers, but Kaypro claims the 286i is the first one that is compatible with the PC AT.

The AT (for advanced technology) jumped the PC family up a level in performance [*ElectronicsWeek*, Aug. 20, 1984, p. 17]. With plenty of memory at its disposal—the AT 5170 Model 68 comes with 256-K bytes and the Model 99 and the Kaypro 286i each have 512-K bytes—the 286 processor gives the AT or 286i a performance of perhaps two to five times that of a standard IBM PC. Both the AT and 286i have sockets for the 80287 math coprocessor, to speed up numerical calculations; Intel is now distributing packaged 287s to computer stores.

The 286i does not have a hard disk, only two floppies. A source requesting anonymity says the reason for this is that Kaypro is strapped for cash, and no drive supplier would grant credit at this time. Without a hard disk, the 286i won't be able to compete with the AT Model 99—the one in really short supply—with its 20-megabyte Winchester drive.



SOURCE: FUTURE COMPUTING INC.

Ramping up. Sales estimates for the IBM PC AT show a slow growth until midyear, with a steeper ramp thereafter. IBM estimates it will sell 315,000 units in 1985; fewer than 100,000 will be sold in the first half.

Same story. It didn't take long for orders for the original PC to pile up to the point that IBM couldn't meet them until it increased production capacity. By that time, several PC clones were on the market, ready to satisfy the pent-up demand. The firm with the most notable success was Compaq Computer Corp. with its original PC-compatible Portable Computer.

The shortage of ATs is attributed to IBM's inability to get enough of the half-height, 20-megabyte hard-disk drives. Tim Williams, a market researcher with Future Computing Inc., also believes that "IBM may be even suprised by the high demand for the product. End users may have been attracted by the product's aggressive pricing, which was only a little higher than earlier IBM models."

Also, the AT's sophistication may have caught other firms off guard. Thus the absence of competitors is due partially to the long lead times required for catching up. Compaq, however, was already in a competitive position with its Deskpro. Introduced at the end of last June—a month and a half before the AT—the Deskpro is selling well, partly on its own merits and partly because it comes close to the AT in performance yet is fully compatible with the PC, while the AT is not.

Williams doesn't believe any competitor is deliberately avoiding developing its own AT-like machines for fear that IBM will eventually meet the demand for ATs. But he does believe that AT clones will emerge in bigger numbers after a year or so. "It wouldn't suprise me if Compaq, AT&T, and others are developing essentially AT-compatible machines."

Short-term problem. The AT shortage may be short-lived, however, because IBM's hard-disk problem is expected to be solved soon, observers note. "IBM is going to succesfully ramp up production [of the AT] by the second half of this year," adds Williams (see chart).

Meanwhile, dealers are converting AT orders into Deskpro orders. According to a Compaq spokesman, many Deskpro customers are buying the machine with the 30-megabyte hard disk and 8087 enhancements to boost its performance. "We are offering the Deskpro as an advanced-capability machine in the capacity range of the AT but not necessarily as a replacement, and it is readily accepted as such," says Len Simon of Inacomp Computer Center, a dealer in Garden Grove, Calif., one of many dealers that is not getting as many ATs as it could sell.

Presumably, some potential AT purchases will be converted to Kaypro 286i purchases now too, especially by dealers that carry both. But Kaypro may have some difficulty getting on dealer shelves where AT buyers browse, says Simon.

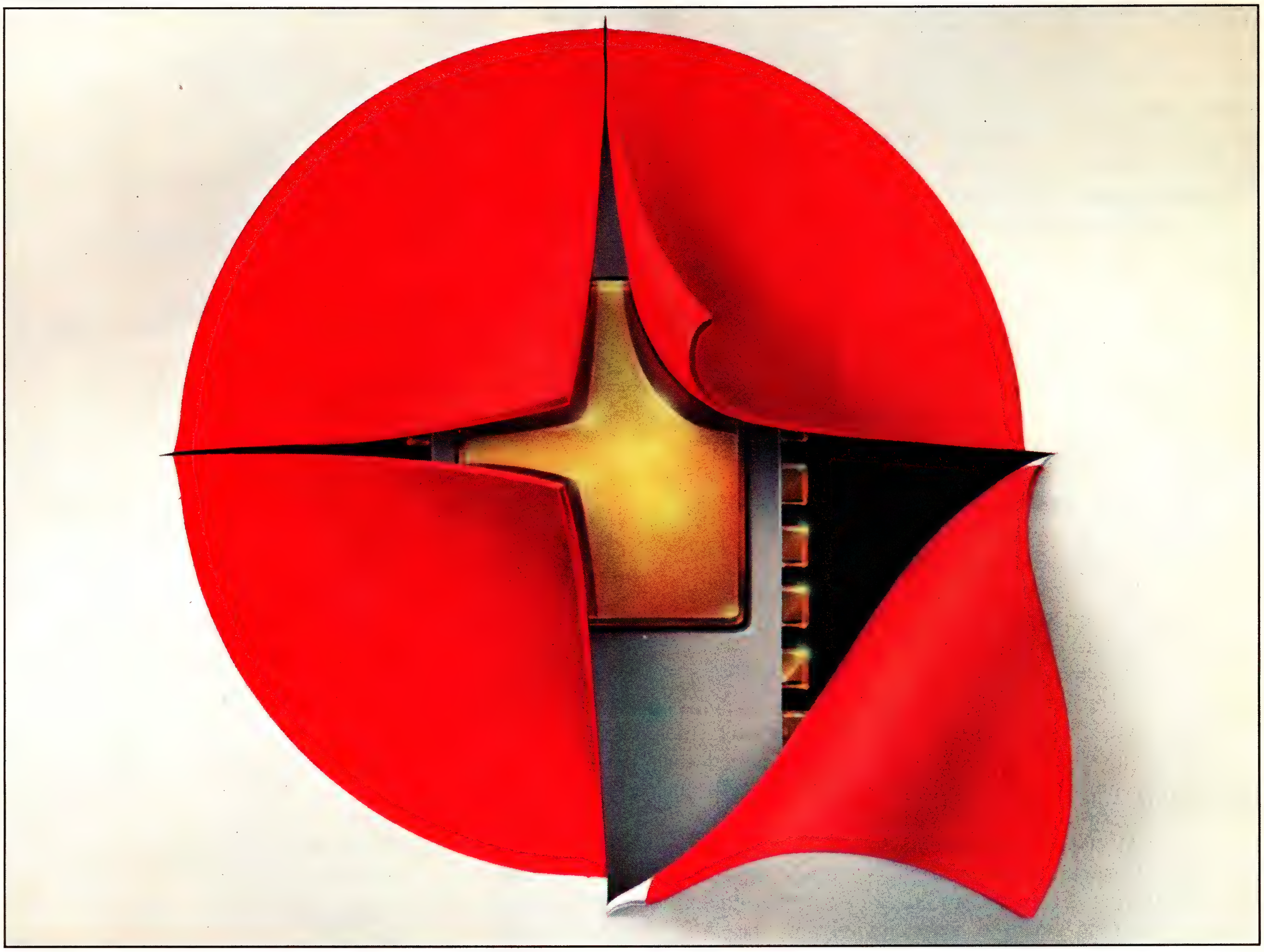
Though AT clones may satisfy some of the pent-up demand for ATs, customers may not necessarily stop waiting for IBM to deliver. Simon doesn't think the AT shortage will necessarily cause a flood of buying of any AT-clone machines or close contenders such as the Deskpro and 286i. "Many users who could use a lot of them [ATs] haven't yet experienced what productivity improvements they would yield, and though they may be clamoring for ATs, they may also wait for IBM to make them available in volume."

Sought after. The very popular PC AT is at home in the office. But there aren't enough of them to go around. Industry observers agree that the shortage may be short-lived, however, since IBM expects to ramp up production in the second half.

Other machines that could benefit from the AT shortage are Tandy Corp.'s 80186-based TRS 80 Model 2000 (introduced in November 1983), AT&T Co.'s 8086-based Personal Computer (released in June 1984), and AT&T's unannounced 7300, code-named the Safari, if it is available in time. (The latest rumored introduction date is March 26. AT&T declines to say anything about the 7300.)

Ron Stegall, Tandy's senior vice president of the Business Products Division, says a price campaign for the 2000 will begin in March. Though he claims this marketing schedule just happens to coincide with IBM's AT shortage, he adds, "We sure hope a whole lot of them [AT shoppers] will take a look at [the 2000]." He also expects more companies to announce AT clones within the next six months. Not even Tandy is ignoring the 286 market, he adds, although he would not elaborate. ☐

Contender. The new kid on the block, the Kaypro 286i, will try to take some of the thunder—and, it hopes, sales—from the much-in-demand AT. Both are powered by an Intel 80286.



SUN RISES ON NEW DESIGNS

Barred from second-sourcing U.S. designs, Japanese manufacturers are developing original microprocessors ☐ *by Charles L. Cohen*

Tokyo

For a variety of legal, technical, and psychological reasons, Japanese manufacturers are going to the design boards to map out the architectures for original microprocessors. The halcyon days of second-sourcing and copying American chip designs are over.

New and stricter copyright laws embracing the designs, and advanced chips with software built in, make it impossible for the Japanese to become unlicensed second sources (illegal copiers) of U.S. manufacturers. In addition, U.S. firms are increasingly reluctant to license new technology to the Japanese even if they are willing to pay for it.

The result is the realization that the time has come for native companies to come up with native designs. And there is an extreme reluctance to divulge details of what's going on behind the closed doors at Japan's prestigious research and development centers. Only one company, NEC Corp., has publicly mapped out its plans to develop its V series of CMOS processors that will cover the range from 16-bit-microprocessor to mainframe performance.

Hitachi Ltd. has shown a prototype 32-bit microprocessor that is upwardly compatible with the 68000 and comparable with Motorola's 68020. But unlike NEC, the company refuses to provide a schedule for the microprocessor's introduction. Perhaps, say some industry wags, that is because even Hitachi doesn't know when that will be.

Mum's the word. Other firms are saying even less as they work feverishly to develop their own 32-bit designs. One reason for their silence is that nobody wants to look bad. Reflecting that, sources at several manufacturers have told *ElectronicsWeek* that they wonder if they can find customers who are willing to use microprocessors that have no software base.

The leading Japanese semiconductor firms—all of which are divisions of computer manufacturers—are caught in a bind because they need proprietary designs for their parent organizations, as the trend continues toward microprocessor engines for computers: though initial requirements are for minicomputers, engines will be needed in the future for ever-larger systems.

The story is quite different at the other end of the microprocessor scale, however. There is much original work going on in 8-bit chips, mostly controllers. This is partly an extension of Japan's many years of experience in designing 4-bit controllers, every one of which is an original because there are no second sources. The ubiquitous 4-bit chips are produced in prodigious quantities and are found in a wide range of consumer products, from rice cookers to low-end personal computers.

The 8-bit controllers are needed for more complex systems, including printers, electronic cash registers, floppy- and hard-disk-drive controllers, other professional and industrial products, and high-end video cassette recorders.

But just how much have the Japanese been able to soothe the sting of the charge that they are merely copiers—unable, by dint of culture and training, to be truly innovative? Japanese manufacturers claim to have developed a large number of original designs, but many in the industry question how truly original most of them are.

Many Japanese microprocessors are upwardly compatible versions of U.S. designs, spiffed up with a cleaner implementation that includes conversion to CMOS wafer processing together with additional instructions and peripheral functions on chip. Improvements to the original have included microprogramming rather than random logic decoding of instructions and the use of additional buses or pipeline prefetch that were not included in the earlier U.S. chip.

License to build. Despite these reservations, Japanese firms have come a long way. Hitachi's 6301 series of CMOS-enhanced versions of the Motorola 6801 are so firmly entrenched in the marketplace that Motorola has taken a license to build them. American Microsystems Inc. has taken a license to build selected versions of NEC's original 78XX series of microcomputers. And both Zilog Inc. and Sony Corp. have become licensees for the first two members of NEC's V-series processors even before they reach the market. Moreover, NEC claims to be negotiating with another American manufacturer interesting in securing a license to build the same chips.

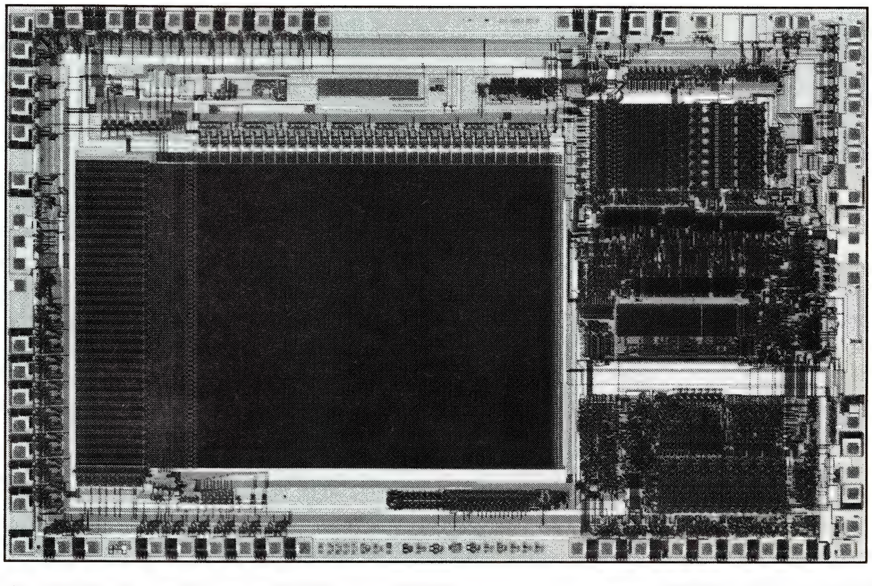
A survey of the state of the lab in Japan would probably give NEC the honors for having the most original and energetic design program. The company has announced a program for developing its V series of CMOS microprocessors. The series extends from a 16-bit processor with an 8-bit external bus to a 32-bit processor with mainframe features such as management for demand-paged virtual memory and a large cache memory on chip (see "First time for second-sourcing," p. 21).

To persons who question the wisdom of building an original processor, NEC senior vice president Tomihiro Matsumura points out that increased production in both Japan and the U.S. makes it mandatory for NEC to work on its own designs. Second-sourcing others was a way to grow up, he says, but now that NEC has the people and the money, it is time for an original product.

Matsumura says the company must make original parts in order to raise its standing in the electronics community. In addition, he says, that is the only way to prevent a trade war.

He claims that NEC is looking for different customers from those now using the 8086 and 8088 and maintains that NEC will not fabricate Intel processors developed after the 8086 and 8088. Although this could limit the potential customer base, Matsumura notes that even 10% of the market would be an extremely healthy business.

The first two members of the V series, the V-20 and the V-30, are 16-bit microprocessors with 8- and 16-bit data lines, respectively, imple-



Their very own. NEC's μPD78p09 microcomputer with 8-K of ultraviolet EPROM is part of an advanced family that the company designed using von Neumann architecture.

mented with 2-μm n-well technology. Their enhanced instruction set is upwardly compatible with Intel's 8086 and 8088—but they feature an original dual-bus architecture. Instruction execution time is thus shorter for many instructions on the V-series than on Intel devices and the two architectures cannot be exchanged in real-time applications. (Meanwhile, NEC and Intel are in litigation over the originality of NEC's microcode.)

Manufacturers wonder if they can find customers willing to use microprocessors that have no software base—nobody wants to look bad in case of a miscalculation.

The V-40 and the V-50 are enhanced versions of the V-20 and V-30 with basic peripherals on chip. The V-60 and V-70 are 32-bit systems with 16- and 32-bit buses that will be implemented with 1.6-μm or smaller design rules.

The V-60 is expected to have 325,000 transistors; the V-70 will have about 700,000. Completion of the V-60 is scheduled for 1986, and that of the V-70 second-generation 32-bit microprocessor for 1987. (For comparison, Matsusmura says that the Motorola 68020 is a first-generation 32-bit microprocessor. The V-70 will be a second-generation product.)

NEC introduced its 78XX series 8-bit microcontrollers in 1979 for electronic cash registers, printers, and other nonconsumer products. Although their architecture is similar to that of Intel's multichip microprocessors, the instruction set was optimized for control applications and is not compatible with any others. The family now has some 15 members, including n-MOS and CMOS types with random-access memories of different sizes and even ultraviolet-erasable programmable read-only memories.

When NEC started on the 78XX series, it chose to use a von Neumann architecture with program ROM and data random-access memory in the same address space because it provides easy expansion with external memory. Intel and Zilog had earlier opted to design their single-chip controllers using the Harvard architecture, with program ROM and data RAM residing in separate address space. All 4-bit controllers use the Harvard architecture, but multichip microprocessors and Motorola's controllers take the von Neumann route.

This year, NEC will start selling its even more advanced 78XXX series, featuring high-speed CMOS for 0.5-μs cycle times. RAM on the chip holds eight register banks for task switching. Next year, the 76XXX series will be introduced by NEC. This is also known as the V25 and is the controller version of the firm's V series.

Hitachi has developed a 32-bit CMOS microprocessor at about the same level of implementation as NEC. But its overall plan is less well thought out. The Hitachi microprocessor has an enhanced instruction set that is upwardly compatible with Motorola's 68000. Compatibility maintained at the object code level, and processing speed of 5 million instructions per second is about twice as fast as Motorola's recently released 68020.

Samples of the new chip are expected to become available during the Japanese fiscal year that starts in April 1986. Volume shipment could start about a year after samples become available. But Stezo Hata, group executive of the Electronic Devices Group, says that Hitachi has not yet decided whether to take an independent path in microprocessor development.

Costly license. Company executives hint that they would prefer to end their dependence on Motorola. But they appear unwilling to take the risk of losing market share. The original design provides insurance in case a license isn't forthcoming and Hitachi has to go it on its own. The price of a license has escalated because Motorola wants not only royalties but insists that the licensee develop its own peripheral chips of the equivalent complexity.

Hitachi has departed from its Motorola orientation with a 6-MHz CMOS Z80 equivalent processor featuring on-chip bank switching for 512-K bytes of RAM, a large number of peripheral devices, and additional instructions. The new design does not signal an abandonment of customers for the firm's Motorola-type processors and controllers, according to Yoshikasu Hatsukano, manager of Hitachi Ltd.'s Microcomputer Technical Marketing Department. Instead, it is an answer to the requirements of customers that need products to sell into markets dominated by CP/M software, including CP/M 2.2, CP/M 3.0, and personal CP/M.

The processor, HD64180, which Hatsukano characterizes as a computer-system integration device, features two direct-memory-access controllers, two asynchronous serial control interfaces, one high-speed clock synchronous serial input/output, and two 16-bit timers. The 8-bit memory refresh timer is designed to refresh 256-K dynamic RAM. Hitachi's goal is to fabricate 10-MHz units. An asynchronous refresh scheme will keep memory power requirements low even at these high speeds.

Hitachi's HD6301 series is an improved p-well CMOS version of Motorola's 6801 with an upwardoy compatible instruction set. All members of the series feature microprogramming for instruction decoding, rather than the wired logic used by Motorola, for a cleaner design and to facilitate adding instructions for changed versions.

Specially designed. Toshiba Corp. has recently unveiled a number of technologies that facilitate rapid implementation of custom systems. The most general-purpose method, with which Toshiba will be first out of the starting blocks, consists of a gate-array chip with 6,000 gates and 1,052 bits of three-port static RAM fabricated in 2-μm CMOS technology [*ElectronicsWeek*, Dec. 3, 1984, p. 29]. Internal elements are sufficient to fabricate original processors of the complexity of the Intel 8085A and Zilog Z80 in gate-array turnaround times. Toshiba will start taking orders in April.

Several chips announced at this year's International Solid State Circuits Conference [*ElectronicsWeek*, Feb. 11, 1985, p. 51] that will probably reach the marketplace later are designed for similar applications. These include a larger gate array from Toshiba, one from Mitsubishi, two from Fujitsu, and a reconfigurable microprocessor from Hitachi.

Toshiba has developed a method of rapidly and inexpensively implementing a standard central processing unit with customer-desired peripheral chips and glue logic as a monolithic system [*ElectronicsWeek*, Jan. 1, 1985, p. 17]. Separate CMOS chip patterns are edited onto a composite mask, with glue logic treated as another chip. The composite system is connected with an second layer of aluminum to form a monolithic hybrid.

Perhaps the high point of Toshiba's original microprocessor design is its T88000 16-bit microprocessor implemented on a silicon-on-sapphire chip [*Electronics*, Oct. 6, 1981, p. 112]. This integrated circuit is actually a monolithic version of a conventional Toshiba minicomputer. It is sold only as a complete system, including off-chip microinstructions, not as a chip. The microprocessor may be a leading indicator of the goals of work going on in Japan on original 16- and 32-bit chips for in-house use.

Toshiba has another solution for a 32-bit superminicomputer that did not fit comfortably on a single chip. It is using high-speed SOS CMOS gate arrays.

Other niches. Most other Japanese manufacturers are aiming their original microprocessors at specialized niches rather than at the mainstream market.

Matsushita Electronics Corp. has been producing 16-bit minicomputer architecture processors for about 10 years. The initial design was developed jointly by Fujitsu Ltd. and Matsushita Electric Industrial Co. engineers. This followed an agreement by the two firms to set up a joint venture to manufacture minicomputers and for Matsushita to fold its minicomputer business into the joint venture.

Since then, Matsushita engineers have designed upwardly compatible versions in finer pattern n-MOS technology. Last year, it produced a processor worked in 2-μm CMOS. The latest version, the MN1617, features 60,500 transistors on a 7-by-6.7-mm chip. It has a 4-megabyte address space and a 200-ns machine cycle. Floating-point multiply and divide are done without a coprocessor.

The original processor that is selling in volume is a completely different kind of processor, according to Hideomi Kato, general manager of the Microcomputer Division's microcomputer development department. The MN1890 series dual single-chip microcomputers feature a virtual two-processor engine that can economically control two processes. The engine acts as a dual processor by making provision for two copies of all the data concerning processor status, including the program counter, stack, status register, and timer.

The ALU, ROM, and RAM are common. A swap mode permits program A and program B to be executed alternately on successive machine cycles with no time lost for interrupt processing.

Mitsubishi Electric Corp. started with the MOS Technology 6502 and designed an upwardly compatible, CMOS building-block version with enhanced instructions for use in controller applications. Chips are laid out with data and address lines along three edges. Individual functions are configured as slices running the full width of the chip. This makes it easy to add new functions to the design.

Yasumasa Iwata, manager of the microprocessor department at the firm's Kita Itami Works says the 6502 was chosen because of its symmetrical architecture. Also, the memory-mapped input/output design makes it possible to change functions without changing instructions.

Most Japanese manufacturers aim their original microprocessor designs at specialized niches, rather than try to crack the mainstream market.

Iwata says that both standard and custom versions are available. Simple custom variations, such as a change in the amount of ROM, take only three months for first samples; more complex changes require six months. This compares with one to two years for a full custom chip.

Suwa Seikosha Co. has developed an 8-bit CMOS microcomputer that features a 200-gate array for convenience in configuring output ports. It says the chip is especially useful in office equipment products, such as printers and disk controllers. ☐

First time for second-sourcing

There is more than originality in design connected with NEC Corp.'s new V-20 and V-30 16-bit CMOS microprocessors. Firms planning to use the chips can count on two—and possibly three—second sources for their chips. Until now, chip customers in Japan did not demand second sources and Japanese semiconductor manufacturers did not make second-source agreements with each other, but that thinking has now changed.

In January, Sony Corp. became the first Japanese firm authorized to second-source a Japanese competitor's chips. Last March, NEC signed a similar agreement with Zilog Inc., and NEC senior vice president Tomihiro Matsumura says that his firm is actively negotiating with another (unnamed) U.S. firm. He further notes that worldwide development-system support will be provided by Tektronix Inc. and Hewlett-Packard Co. Both Zilog and Sony are expected to ship products by the end of this year.

Fumio Kohno, Sony senior general manager for the Semiconductor Group, says that his firm started outside sales of semiconductors in 1983 and needed high-level digital products. Sony decided to second-source the NEC chips because that firm has an excellent reputation in semiconductors and the V series is a superb product line. Sony already makes 4- and 8-bit microprocessors, but according to Teruaki Aoki, general manager of the Integrated Circuits Division, the 8-bit processors are only used in house.

Development of different peripherals may be shared among NEC and its licensees, but no agreements have been reached yet. Licenses for more advanced models await completion of the products. —C.L.C.

Data
Communications
1984
Brand Preference Survey

McGraw-Hill

Rental and Lease
Organizations

Who's got the best service...by far and away?......

And who says so?.................................

*1984 DATA COMMUNICATIONS Brand Preference Survey Study conducted by McGraw Hill Research.

Best Service Organization

Total Respondents Answering 1980	Total Respondents Answering 1982		Total Respondents Answering 1984		Purchase Decision Makers 1984	
%	%		#	%	#	%
100.0	100.0	BASE OR 100 %	127	100.0	71	100.0
18.5	16.5	GENERAL ELECTRIC CO.	37	29.1	25	35.2
10.9	8.2	RCA SERVICE CO.	18	14.2	9	12.7
13.0	24.7	LEASAMETRIC	12	9.4	7	9.9
—	3.1	AMERICAN COMPUTER GROUP INC.	7	5.5	2	2.8
—	—	GLASGAL COMMUNICATIONS INC.	6	4.7	4	5.6
—	2.1	U.S. INSTRUMENT RENTALS	6	4.7	3	4.2
6.5	5.2	ALANTHUS DATA COMMUNICATIONS CORP.	5	3.9	1	1.4
4.3	1.0	ELECTRO RENT	3	2.4	2	2.8
—	—	*IBM CORP.	2	1.6	1	1.4
1.1	2.1	AMERICAN TERMINAL LEASING CO.	1	.8	1	1.4
—	—	GENSTAR RENTAL ELECTRONICS INC.	1	.8	—	
—	—	OTHER	8	6.3	4	5.6

*DENOTES COMPANIES WRITTEN BY RESPONDENT UNDER "OTHER"

……………………………………………GE

……………………………………………You.*

Almost 1,700 of you, selected at random from the circulation list of *Data Communications*. In the category of "Rental and Lease Organizations," GE was named "Best Service Organization" by a ratio of almost 2 to 1.

As a matter of fact, of the 20 categories in which GE was rated, we came out on top in 14.

We credit these outstanding results to our belief that in the data communications business, service is the name of the game. That's why we staff our GE service centers with trained technicians, and offer a comprehensive list of products, from manufacturers such as Hewlett-Packard, Tektronix and Fluke.

For rental and lease, all you need is one—#1. Just one phone call is all it takes. Or, mail the coupon below.

1-800-GE RENTS

(1-800-437-3687)

EW

Please send me my free catalog on renting or leasing. I am particularly interested in the following:

☐ Personal Computers
☐ Data Communications Equipment
☐ Electronic Testing Equipment
☐ Industrial/Electrical Equipment

Mail to: Chuck Cornwell, General Electric Company, 5775, Peachtree-Dunwoody Road, Suite 500-G, Atlanta, GA 30342.

Name____________________________

Address____________________________

City________ State________ Zip________ Phone________

*A registered trademark of General Electric Company

Circle 23 on reader service card

BELLCORE RESEARCHERS LEVITATE WAFERS

Murray Hill, N.J.

By wafting their wafers, scientists at Bell Communications Research have managed to grow epitaxial layers on substrates with no physical contact. They do it by using gas jets to move wafers pneumatically through the entire growth process, known as vapor-levitation epitaxy.

The system consists of two adjacent growth chambers with porous tops and a horizontal levitation track with a series of gas jet holes at its center (see figure). After premixing, each chamber is separately filled with growth vapors, carrier gas, and dopants as a wafer is transported along the levitation track. Once inside the chamber, the wafer is suspended a fraction of a millimeter above the porous disk as epitaxial growth occurs on the underside of the substrate.

Growing GaAs. According to Herbert M. Cox of Bellcore's Photonic and Electronic Materials Research staff here, gallium arsenide, indium phosphide, and indium gallium arsenide as well as quantum-well heterostructures have been grown on 2-in. substrates. The former Bell Laboratories researcher published the first vapor-levitation-epitaxy announcement in the *Journal of Crystal Growth* last September.

Up to 202 layers have been applied so far to wafers using the vapor-levitation-epitaxy process, explains Vassilis G. Keramides, district research manager for Bellcore's Applied Research branch. The prototype system was designed to demonstrate the concept, he adds, not for the production of wafers.

As a result of the breakup of AT&T Co., Bellcore is prohibited from manufacturing products for its owners, the seven Bell operating companies. Chips that would ultimately be produced by outside vendors using vapor-levitation epitaxy would have applications in data transmission systems using fiber-optic technology, says Keramides.

Fast transistors. Along with optoelectronics devices, Cox also sees selectively doped heterojunction transistors and high-electron-mobility transistors as probable applications of the process.

The placement of a second chamber adjacent to the first is the greatest advantage of the technique, explains Cox. In this configuration, each growth chamber can receive reactants, dopant, and carrier gas independently of the other chamber. Thus an epitaxial layer can be grown in one chamber while flows are established and equilibrated through the other chamber.

This so-called steady-state equilibrated condition allows wafers to be moved rapidly between chambers for extremely abrupt interfaces between layers, explains Cox. Equally important, the wafer-transport technique could be suitable for production environments.

If potential problems such as gas temperature control and wafer transport stability can be overcome, says Walter C. Benzing of Applied Materials Inc., Santa Clara, Calif., vapor-levitation epitaxy could work. "It's a variation on the air-track wafer transport [system]. You might have a concern with stability. That's always been a glitch with the air tracks."

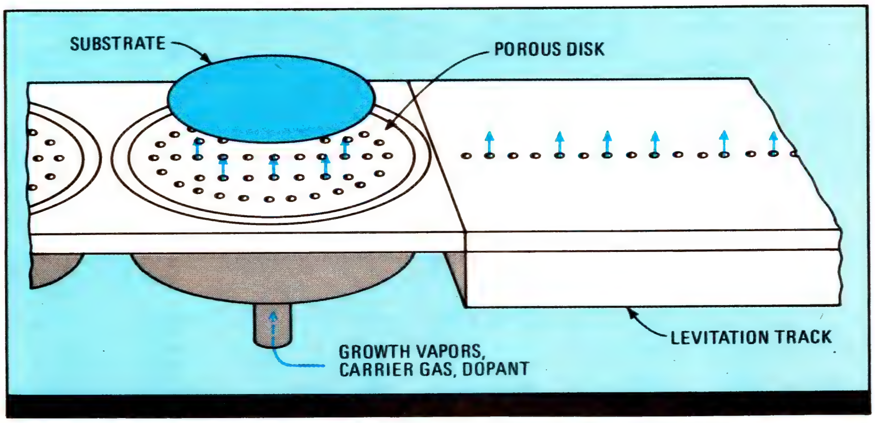
Pretty uniform. Benzing adds that the introduction of growth vapors from below means that "the composition ought to be pretty uniform across the surface." Indeed, Cox reports variations in deposition uniformity of only 2% over a 2-in. wafer.

Moreover, he explains that gas temperatures in the growth chamber are controlled in the same way as for composition in the premixing step. A "built-in dynamic stabilization" maintains stability. If any edge drops because of reduced flow, a force vector reorients the wafer so it is parallel to the porous disk.

Cox does not see any tradeoffs in the new process compared with present technologies such as liquid-phase epitaxy "because what it is doing is combining the best of earlier technologies." Vapor-levitation epitaxy has yielded higher levels of purity, high uniformity, larger wafer sizes, and faster throughput, according to Cox.

The project began here in 1983 while Cox and Keramides worked for Bell Laboratories. AT&T Bell Labs holds the patent on vapor-levitation epitaxy, but most of the work was done at Bellcore, Cox says, adding that the system has been well received at technical workshops and he has been invited to speak at several universities.

The entire prototype system—according to the scientists, the only system of its kind—was built by another Bellcore researcher, Steven G. Hummel. Hummel and Keramides are expected to publish details on a more complete system design soon. For now, says Keramides, "we are trying to influence the direction of the technology." –**George Leopold**



Stable. The vapor-levitation epitaxy system developed by Bell Communications Research uses gas jets to keep wafers aloft and parallel throughout the growth process.

EUROPE GOES CASHLESS WITH FUNDS TRANSFER

London

Cashless shopping has been slow to catch on in Europe, but its prospects are suddenly brightening as ambitious schemes for electronic payment get under way in Denmark, France, and the UK. Each scheme is being planned on a national level, so that a single card will be able to buy goods and services anywhere in the respective country. Questions about funding and retailer acceptance remain, however.

For two reasons, Denmark is likely to be the first European country to establish a nationwide cashless shopping network. First, Danes have never taken to credit cards, so 15 of Denmark's leading banks have been looking at alternatives. Second, the country is small enough for an electronic funds-transfer system at the point of sale (Eftpos) using existing technology.

In November 1984, the first phase of a nationwide Eftpos went live with a few thousand terminals. Within two to three years, an estimated 80,000 terminals will be in operation, with almost half of Denmark's population participating as card holders.

The system, run by an operating company that has been set up jointly by the banks, relies on a single computer center equipped by Christian Rovsing A/S. The hardware is highly modular and can be expanded as the network grows. Connections between computer-center and point-of-sale terminals are made over the public switched telephone network.

The French way. Beyond a certain size, centralized computer systems can get swamped with traffic. France has adopted an alternative—one that is more appropriate for a larger country with a greater number of potential users. Called the smart card, it is a piece of plastic the size of a credit card and holds built-in memory and a microprocessor.

The smart card has a variety of uses. It keeps personal records, permits security access, serves as a standard credit card, or works in cashless-shopping systems [*Electronics*, Jan. 26, 1984, p. 92]. French banks have already agreed to a common standard, and the next stage is to move to a nationwide system. Four regional card projects were authorized last week, and up to 2.5 million cards are expected to go on line soon. A possible snag, though, is the cards' high cost—between $5 and $6 apiece.

On-line project. Across the channel, the UK's 15 clearing banks—called thus because they are the ones that clear the nation's checks—decided last month to set up a nationwide cashless shopping system. This on-line project has the support of Britain's largest retailers, which are represented by the Retail Consortium.

British Telecom and IBM (UK) Ltd. will develop a network of computers for the project—rather than a single central computer, as in the Danish system—and an operating company will be set up to manage the network. Meanwhile, systems specification and software development are going ahead at a cost of $20 million. The project's first phase will go live in two years.

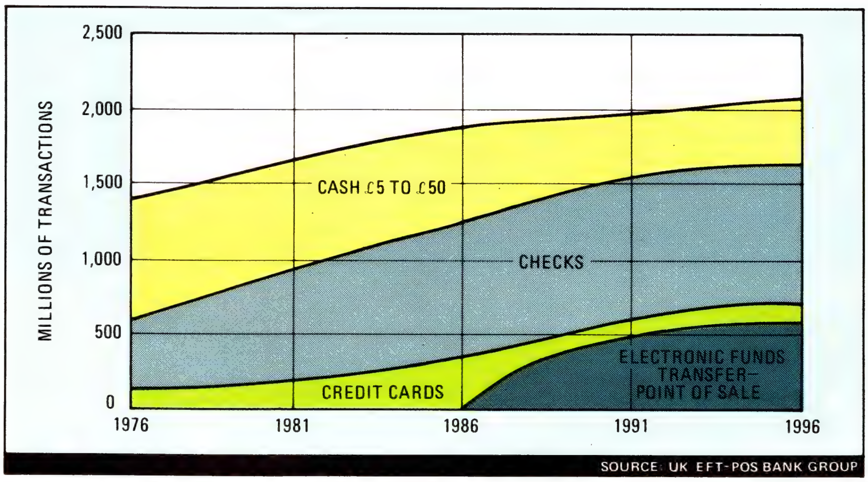
As it is now constituted, the system breaks new ground by relying on a distributed computer setup, with dual IBM Corp. Series 1 computers dotted around the country in local telephone exchanges. Because the network is distributed, it can be expanded indefinitely, unlike centralized schemes.

Security, however, is more of a headache because the network has so many access points. In response, IBM and British Telecom have developed what they consider a foolproof security system, which could make them major players in the world Eftpos market.

Secure funds. There are two basic security issues in Eftpos: the need to verify the caller's identity and to protect the network from intruders. Thus data is encrypted at two levels.

First, Data Encryption Standard gear (conforming to International Organization for Standardization protocols) is attached to every link in the network, scrambling messages so they are made unintelligible to outsiders. As a further safeguard, and to authenticate the identity of the card holders, messages are encrypted from end to end—that is, from the card holder and retailer to their own banks. This means that messages never break down into plain text.

By adopting the ISO's open-systems model instead of proprietary IBM protocols, companies should be free to compete to provide Eftpos terminals. As many as 100,000 terminals could be sold in Britain within the next 10 years, according to Ian Chandler, International Computer Limited plc's marketing manager for Eftpos. **–Kevin Smith**



SOURCE: UK EFT-POS BANK GROUP

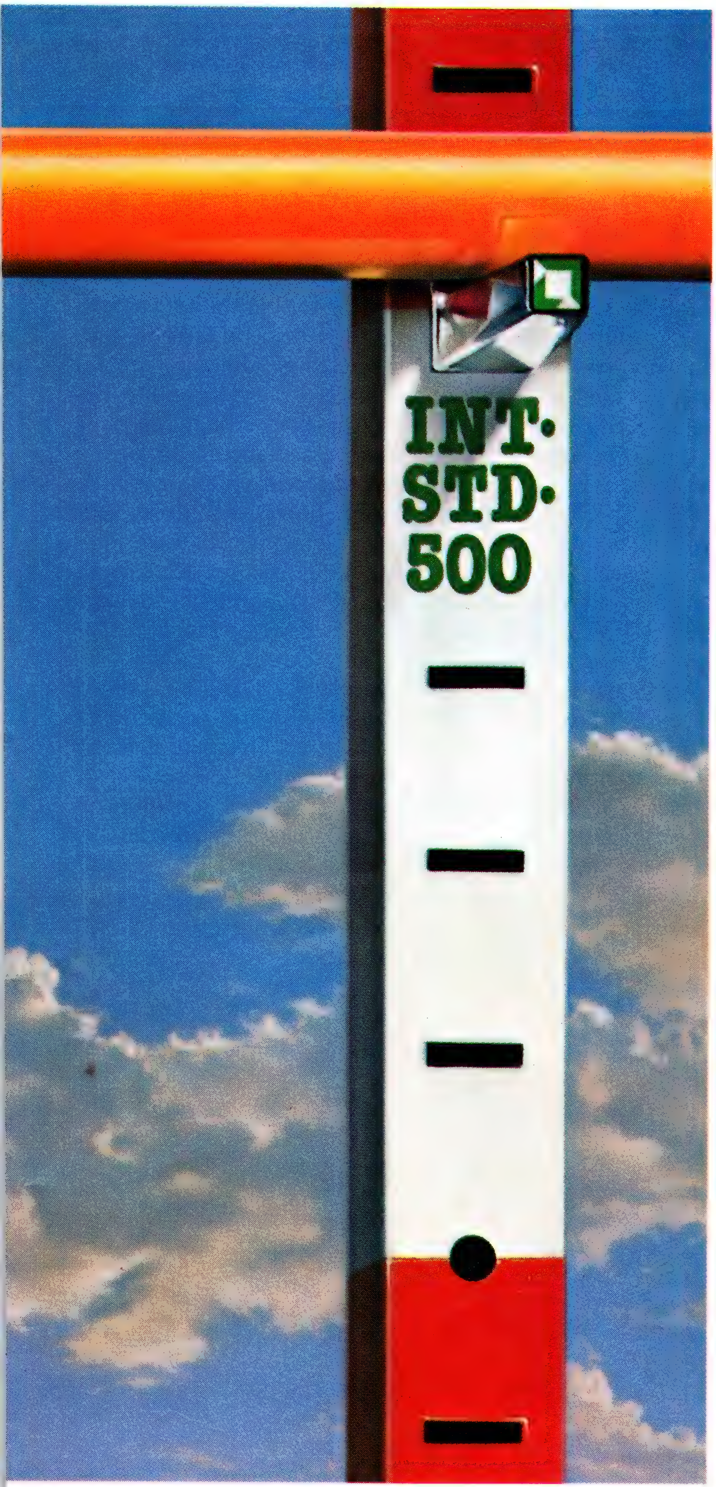
Starting soon. Consumers in Britain can start using electronic funds transfer in 1986. By 1996, the use of smart cards could rival that of credit cards but would still be far less than checks.

WE

©1985 Advanced Micro Devices, Inc.

Advanced Micro Devices • **Bruxelles** (02) 771 99 93 • **Hannover** area (05143) 5055 • **Hong Kong** (852) 3 695377
London area (04862) 22121 • **Manchester** area (0925) 828008 • **Milano** (02) 3533241 • **München** (089) 41140
Paris (01) 687.36.66 • **Stockholm** (08) 7330350 • **Stuttgart** (0711) 62 33 77 • **Tokyo** (03) 345-8241

JUST RAISED THE BAR.



Announcing INT-STD-500.

Once again, we have raised the International Standard of Quality to new heights.

Once again, we are guaranteeing AQLs on every part across the board. No ifs. No ands. No buts.

Once again, we have set a standard so high that only one company will top it.

Ourselves.

The International Standard of Quality guarantees a 0.05% AQL on all electrical parameters, AC and DC, over the entire operating range.

INT·STD·500

Advanced Micro Devices

For more information, contact the sales office nearest you or write the word "Bar" on your letterhead and mail to
Advanced Micro Devices, Mail Operations, P.O. Box 4, Westbury-on-Trym, Bristol BS9 3DS, United Kingdom.

BRITISH GaAs CHIPS GO TO MARKET

London

Although gallium arsenide chips operate at speeds four or five times faster than their silicon counterparts, the embryonic market for them marches at a more measured pace. So the three UK semiconductor houses that are now readying to get into the commercial-chip business—about a year after Harris Corp. pioneered in the U.S.—figure that they can find a place among the front runners when the technology's time comes.

As is the case with most of their U.S. counterparts, the British trio—General Electric Co. plc, The Plessey Co. plc, and Standard Telephones and Cables plc—have acquired their GaAs expertise through military development contracts. In fact, Britain's Ministry of Defence has slated GaAs technology for use in monolithic microwave ICs (MMICs) as well as for high-speed digital signal processing.

But taming the technology has been a slow process. When the program started 10 years ago, gallium arsenide was in short supply and of poor quality. What's more, researchers had to await the development of fine-line lithographic gear, ion implanters, and other production-line equipment.

Pilot production. These problems have been solved, and for the past six months both Plessey and GEC have had pilot production lines running. STC expects to have clean rooms in operation at some time in the second half of the year.

These lines represent an investment between $3 million and $4 million for each company. Now that they are ready for production, their strategy is to start off with a handful of standard chips—in most cases, designs originally developed for an inhouse defense project—and fill out a portfolio with basic digital and MMIC building blocks. In addition, to quickly fill their expensive production lines, the British GaAs producers are hoping to find a mix of custom, semicustom, and foundry business in world markets.

But the competition is going to be fierce. Government funding has been the prime mover for most GaAs development and European governments have not been lavish. In 1984, according to the market research firm Strategic Inc., U.S., European, and Japanese governments laid out more than $513 million for GaAs research and development. Fully 65% of that was spent in the U.S.; Japan came in second with 24%, and Europe was last with 10%.

Looking for a payoff. Nonetheless, the UK crew figures it can find worthwhile market niches. Plessey, for example, pioneered III-V semiconductor development in partnership with Britain's Royal Signals and Radar Establishment. Now, Plessey is looking for the payoff. It has started sampling a six-chip set that implements the complete transmit/receive function for a phased-array radar.

These chips will be made in Plessey's Process I, a 1-μm depletion-mode process using epitaxially grown material. This will be supplanted around midyear by an ion-implanted process with submicron dimensions.

Using only eight masks instead of the 14 needed for the older process, Process II will be a high-yield process, asserts George Gibbons, general manager of Plessey's Solid State Research Division.

By 1986, Plessey expects to have a super-analog process up and running. This planar process utilizes self-aligned gates and selective ion implantation. It makes possible both depletion and enhancement devices on the same chip, a combination that consumes little power.

Double-teamed. GEC has two GaAs groups at work in its Hirst Research Centre. One, headed by John Summers, is developing a basic depletion-mode process for immediate production. The other, under the direction of Joseph Barnard, is start-

ing with a clean slate of technology.

The flagship product for the first group is an amplifier chip whose bandwidth stretches from 10 MHz up to 12 GHz. The chip—a natural for electronic-surveillance applications—is now being sampled. Thanks to its distributed-amplifier structure, four such chips can be hung together to provide 24 dB of nominal gain. "It has already raised a lot of interest," says Colin Corbey, newly appointed marketing manager for GEC's activity.

High costs attacked. Meanwhile, Barnard's team has tackled two major problems for operators of GaAs works: the high costs and long delays involved in the production of custom chips. Typically, an MMIC chip can cost up to $150,000 and take up to 12 months to develop because of the complex simulations involved.

Yet Barnard proposes to offer a one-month chip-prototyping service starting in the second quarter of 1985. By using direct electron-beam writing to eliminate costly mask making, and a library of precharacterized cells to cut down computer simulations (see photo), GEC figures it can cut design time and costs by an order of magnitude.

Chip specifications will be sent over the telephone and designs run on Digital Equipment Corp. VAX computers, Barnard says. The service will become more effective as the cell library builds to include counters, logarithmic amplifiers, and the like.

Similar to Hewlett-Packard Co.'s buffered FET logic, Barnard's process can combine optical and microwave functions on a single chip. In GEC's phased-array radar, for example, individual elements will be optically switched by a built-in light-emitting diode/detector combination.

Unlike Plessey and GEC, Standard Telephone is using GaAs to make super-fast logic for advanced military and communications equipment. Later, STC expects to move on to the higher densities needed for computer chips. The firm then will face stiff competition from Japanese chip makers. But it has one potential solid customer: Standard Telephone recently bought Britain's largest computer maker, International Computers Limited plc.

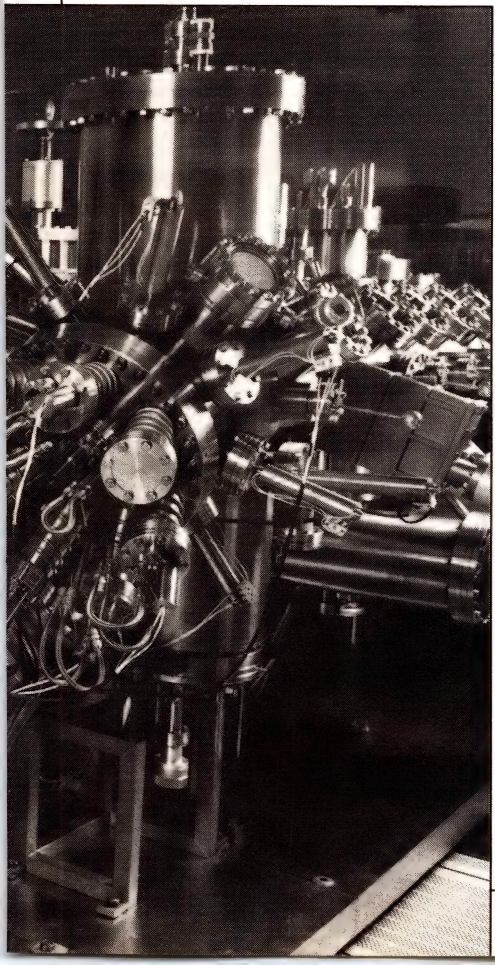
Low-power processes. For GaAs logic chips, circuit densities are very high and to achieve them a low-power process is essential. That is why both STC and Japanese companies have gone for a direct-coupled FET logic process.

STC is starting off with a 1-μm, two-layer metal process. With it, the company expects to launch a handful of standard logic circuits this year. Among them are a 900-MHz synchronous counter, a 100-bit memory, latched adders, shifters, and other medium-scale-integration parts.

One of the company's first products will be a 900-MHz prescaler with an 18-mW consumption. It can can be used as a front end in communications gear such as cellular radio or in test instruments, frequency synthesizers, and the like.

Ironically, neighboring Plessey has dominated the UK fast-logic market with its high-speed emitter-coupled-logic parts. With STC threatening with GaAs, Plessey intends to complement its line of ECL 1-GHz divider chips with GaAs chips running at speeds up to 4 GHz.

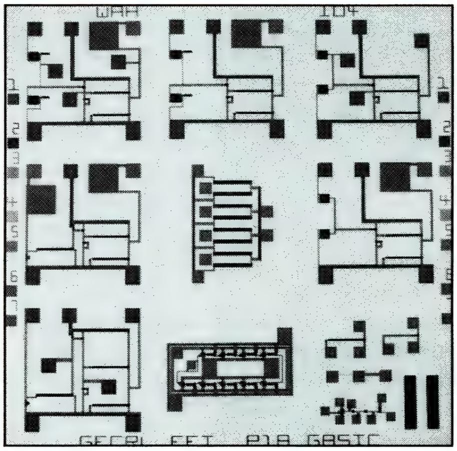
The STC digital process works for high-performance analog functions as well. For example, it is suited for parts such as an operational amplifier having 1-ns settling time and a gain of 1,000, or a 10.7-MHz tunable filter that utilizes switched-capacitor techniques. **–Kevin Smith**

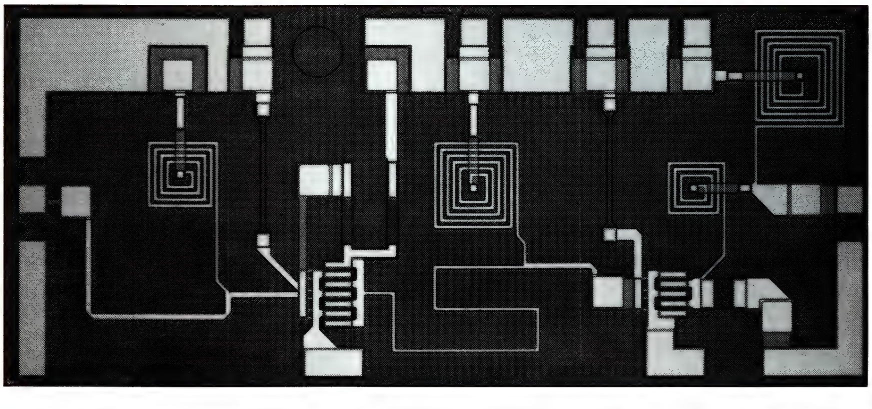


Fine control. General Electric Co. plc uses molecular-beam epitaxy (left) to create GaAs and GaAlAs structures in layers only a few atoms thick.

Time saver. To slash turnaround time and costs of prototypes for semicustom GaAs devices, GEC fabricates a chip (right) from macrocells and hooks them up by direct electron-beam writing.

Up front. One of Plessey's first GaAs chips (below) will be this low-noise radar amplifier. It has 28-dB gain, less than 3-dB noise figure, and 7- to 11-GHz operation.





HIGH-TECH LEG IRONS PUT TO THE TEST

Minneapolis

As overcrowding in U.S. jails and prisons becomes an increasingly serious problem, some computer-system vendors are betting the time is ripe for the electronic equivalent of the old ball and chain.

If the idea works, penal officials will soon be strapping up the ankles of their prisoners. But they won't be using heavy leg irons. Instead, future nonviolent criminals may be lashed up with radio transmitter-equipped rubberized leg bands and sent home to serve out their sentences.

The idea is being tested in West Palm Beach on work-release and parole-probation prisoners with a system known as the In-House Arrest System. Made by Controlled Activities Corp., the system is being marketed by Pride Inc., a nonprofit agency that operates probation services in Florida.

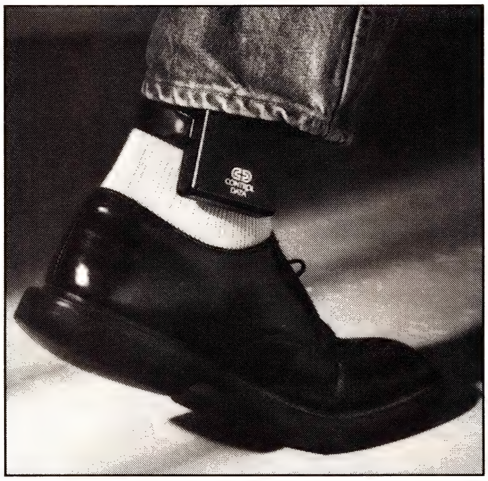
What's more, Control Data Corp. has also recently jumped into the business with a system it calls the CSD Home Escort. Developed by National Incarceration Monitor and Control Services Inc. (Nimcos), the system is being offered by Control Data's Corrections Systems Division here, which recently picked up exclusive North American marketing rights.

Nimcos was unsuccessful in marketing an earlier version of the system. But officials at both firms are hopeful that the marketing clout, service, and support offered by Control Data will now be enough to sell the idea.

Gotcha. The Home Escort and the In-House Arrest systems work in a similar manner. Both use a waterproof, battery-powered transmitter about the size of a cigarette pack that weighs 3 to 5 oz and is worn on the prisoner's leg.

The leg-band transmitter sends out digital radio-frequency signals, with a range of 55 to 175 ft, that communicate with a receiver plugged into the wearer's home telephone and a standard ac outlet. In turn, the battery-backed receiver communicates periodically over phone lines with the system's central computer at the jail, police headquarters, or probation office.

As long as the person wearing the leg band remains at home within range of the receiver, the system continues to monitor the signals. But if the signals stop, indicating the wearer has left his quarters, the receiver sends a report or an alarm to police headquarters. In both cases, the central computer contains hard-disk storage to keep track of the prisoner's comings and goings (prisoners are allowed to leave home at a certain hour each day to report for work-release duty). In addition, the system generates daily reports on each individual monitored.



Tamper-proof. Control Data's system contains embedded wires, so an alarm is sent if the leg band is removed or stretched beyond a certain limit.

Although similar in concept, the systems sold by Control Data and Pride vary widely in price. For a setup that can monitor 15 prisoners, the In-House Arrest System sold by Pride goes for about $28,000; its 100-prisoner system sells for about $104,000. Control Data offers its Home Escort system for about $300,000 for a 15-prisoner system and for about $1.3 million for a 100-prisoner setup.

Richard T. Mulcrone, general manager of operations for Control Data's Corrections Systems Division, says the Home Escort's higher price buys a totally tamper-proof system. The leg band used in the Home Escort contains embedded wires; thus the system can send a tamper signal to the receiver if the leg band is removed or stretched beyond a certain limit. This in turn triggers an alarm at the central computer. By contrast, he notes, the leg band and software used in the competing In-House Arrest System contains no such anti-tamper feature.

Not escape-proof. Glen Rothbart, Pride's director of programs, confirms that a prisoner being monitored by the In-House Arrest system could cut off the leg band in his home, place it next to the receiver, and leave home without detection. But this would be a parole violation that would ultimately land the offender in jail, and a work-release prisoner would be charged with escape.

Rothbart emphasizes that the prisoners who are put on the system have to be carefully screened, so that only those who are not likely to tamper with it are selected. In any event, he adds, the system is designed to be used with nonviolent offenders, such as habitual traffic violators or those convicted of driving under the influence of alcohol. "We don't have any hard-core felons on this system. It's not made for that."

Officials at both Pride and Control Data say their respective systems could save money for taxpayers. Costs using the Home Escort system would total about $4,200 per prisoner per year for a 15-person system, based on a five-year amortization schedule, according to Nina L. McGuire, national sales director for the company's Corrections Systems Division. This cost would drop to about $2,700 in a system that handles 100 prisoners. In comparison, it is estimated that the city of New York currently shells out about $40,000 in annual maintenance costs per prisoner. –**Wesley R. Iversen**

PHOTOVOLTAICS

NEW MATERIALS CUT SOLAR-CELL COST

Constance, West Germany

Like necessity, economy is often the mother of invention. And it was economy, above all, that gave birth to a new kind of silicon solar cell being studied by a university team in this town in the extreme south of Germany.

Conventional solar cells have achieved impressive capabilities over the past decade: long-term stability has been increased to 30 years and power-conversion efficiency boosted to about 18% for outer-space applications, for example. However, experts now consider even the less costly terrestrial cells too expensive. They are difficult to manufacture, and temperatures close to 850°C are needed to produce the pn junction that performs the actual energy conversion. The cost of generating a single watt with photovoltaics is usually between $4 and $5.

Making the break. Peter Munz, head of a solar-cell research team at the University of Constance, laments this price-to-performance ratio. So his group has made a firm break with the pn-junction approach by using a metal-insulator-semiconductor technique to make relatively simple silicon solar cells.

An MIS cell requires fewer manufacturing steps than does a pn-junction cell and can be made at temperatures as low as 500°C, Munz explains. A further contribution to low cost comes from the fact that inexpensive polycrystalline silicon can be used as the substrate without an appreciable drop in energy-conversion efficiency.

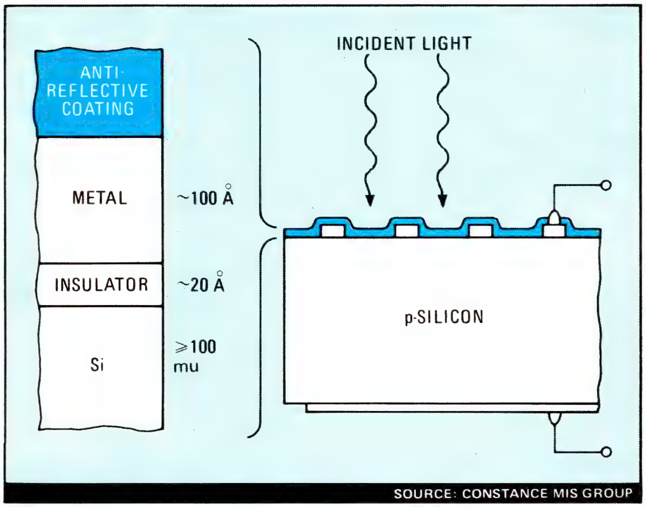
With this method, the Constance team has produced experimental cells boasting an efficiency of better than 12%. "Extrapolations of the results obtained thus far point to a long-term stability potentially equaling that of conventional solar cells," Munz says. The finished devices function even after being subjected to a 400°C heat treatment for 20 minutes, and no harmful interlayer diffusion is detectable.

To be sure, the Constance team is not the only one working with these solar cells. Teams at the State University of New York at Buffalo in the U.S. and at an Australian university are also studying the technology.

"But we believe we are the first to look at a continuous-metal-film MIS cell in its entirety, not just at certain aspects of it," Munz says. "We are paying particular attention to the materials question."

Made in layers. The cell's simplicity is evident in its construction. First, a 20-Å-thick insulator layer is fabricated on a p-type silicon substrate that is at least 100 μm thick (see diagram). This is a silicon layer produced in an oxidizing atmosphere at about 500°C.

Next, a semitransparent metal film, roughly 100 Å thick, is deposited on the whole cell surface in a thermal evaporation process (other processes for this step are also feasible). After this comes the metallic current-collecting grid. The whole cell is then covered with an antireflection coating, and then completed by adding aluminum ohmic contacts. No diffusion takes place during the entire fabrication process.



SOURCE: CONSTANCE MIS GROUP

No junction. An MIS solar cell consists of a 20-Å-thick insulator between a silicon substrate and a metal current-collecting grid.

The key layer in this design is the rare-earth element scandium, a highly reactive metal that, in conjunction with the strongly doped silicon substrate, gives a high open-circuit voltage. This is a prerequisite for high cell efficiency.

Light in action. In operation, the metal layer induces a space-charge zone just under the substrate surface. Incident light creates electron-hole pairs, which are separated by the electric field under the substrate and lead to the generation of a photocurrent or a photovoltage between the cell terminals. Thus, the operating principles are similar to those of a pn junction except for the location of the electric field, which is deeper within the substrate in a pn-junction cell. This makes for a high sensitivity to visible light at relatively short wavelengths.

According to Munz, investigations have shown that "the MIS cell lends itself well for use with very cheap substrate materials that are inherently highly doped." Therefore, despite its simplicity, high open-circuit voltages can be obtained with substrate materials having resistivities as low as 0.1 Ω-cm. This, in turn, leads to an efficiency of better than 12% in its present state of development—fully comparable to standard terrestrial cells.

Under AM1 conditions—that is, when 100 mW of light energy hits 1 cm^2 of cell—the open circuit checks in at 625 mV for a monocrystalline silicon substrate; this value is now obtainable only with sophisticated pn-junction cells for use in space. With polycrystalline silicon material, the open-circuit voltage drops only slightly, to just 595 mV, making it possible to use the much cheaper polycrystalline material and still get high performance. –**John Gosch**

SOFTWARE

SPEED COUNTS MOST FOR ADA COMPILERS

New York

In the growing market for Ada compilers, the question for suppliers is which comes first—performance or validation.

For Robert L. Bergman, director of advanced systems for Gould Inc., the answer is performance. Gould chose a compiler from Irvine Computer Science Corp. for a flight simulator it is developing with Science Applications Inc. for the U.S. Navy because the product was the best performer on the market, even though it hasn't been validated, says Bergman, who made the purchase decision.

Testing of Irvine Computer's Ada compiler will take place in mid-March in the simulator, the F4J Weapons System Trainer, which will provide the product's latest hurdle in the market race. "This project is the first in the world to convert a whole flight simulator into Ada and have it run," says Bergman.

Covering all bases. Just in case validation wins out over performance, however, Gould is hedging its risk. The firm has contracted with TeleSoft to provide a validated Ada compiler as a backup in case the Irvine compiler doesn't fly because of validation problems.

But Gregg H. Moulton, a member of Irvine's technical staff, is confident that his firm's eventual push for validation will only speed up performance of its Ada compiler even more, not make it slower. Meanwhile, he points out, "the Air Force bought ours, didn't they?"

Irvine Computer swears by its product's usability. Its compiler, possibly the fastest and smallest on the market, has been used for systems flying in the McDonnell Douglas F-15 and Northrup Corp.'s F-20. Ada code generated by the handcrafted compiler is at least three times faster than typical compiled Fortran and two to three times as fast as C, says Moulton.

The newest Ada compiler from Digital Equipment Corp., the leader in validated Ada compilers, is due on the market around April 1 [*ElectronicsWeek*, Jan. 14, 1985, p. 18]. Yet code generated by Digital's validated Ada compiler will perform only within 10% of the speed of code from the firm's Fortran compilers, says Bob Abramson, VAX Ada products manager. Abramson says Digital's advantage is that the compiler is a mature product that "fully implements the Ada language."

Flying high. Irvine Computer Science's Ada compiler, used for systems in Northrup Corp.'s F-20, is winning users.

Industry analysts note that validated products might be blessed, but they are useless if they can't be used in applications requiring high speed.

Tartan will release a nonvalidated Ada compiler around November 1. The Tartan-Ada will reportedly outperform currently validated Ada compilers by 40% to 50%. The company's software uses a previously validated front end that is being reengineered. In addition, Tartan has developed a compiler-compiler for mass production of its Ada-compilers, which are usually handcrafted.

Those favoring performance over validation are confident that Ada's original writers intended the language to simplify itself. Jim Magnusson, Ada manager of Science Applications Inc., says that in working with the F4J simulation project, his company learned more about Ada and how its developers intended that subroutines should be folded in.

"Due to the richness of the language, it can have any structure you can conceive," he says. "The Irvine compiler has enough [of the full Ada language] implemented to allow systems to be constructed in Ada now." Traditionalists warn against too many suppressions, however, and making compilers that don't really exploit Ada's capabilities. **–Merja Lehtinen**

COMPUTERS

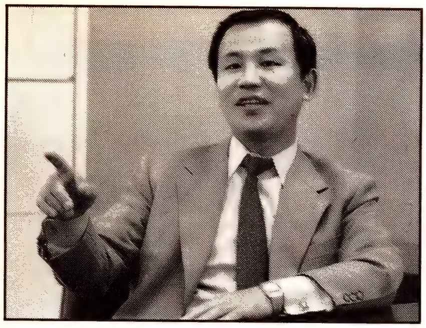
TOSHIBA, SHIINA IN SORD PLAY

Tokyo

Just a few years ago, Sord Computer Corp. owned 20% of Japan's business-computer market, became a leader there in sales of business software, and attracted investors willing to pay $292 for a share having a face value of just $2.08. "Our bankers think we can become the Sony of the personal computer age," boasted Sord's founder and president, Takayoshi Shiina.

Today, the bankers are nervous and Shiina's dreams for Sord have all but disappeared. His company's market share for business computers has fallen to about 4%, attempts to market a new portable computer abroad have failed, and 1983 net profits of $6.6 million have drowned in a flood of 1984 red ink.

For months, Shiina has been looking for a savior. Last week, he may have found one, but at a high price: he has probably lost control of Sord. Toshiba Corp., seeking a way to expand its lackluster position in the market for small business computers, has agreed to acquire 37% of Sord stock, and is negotiating for an op-



Tough choice. Takayoshi Shiina has seen Sord, the firm he founded, plummet, forcing consideration of a takeover bid by Toshiba.

tion to acquire an eventual 51%.

The only thing holding up an official announcement is Shiina's reluctance to approve an eventual takeover, but sources close to the negotiations expect details to be worked out soon. Whatever the result, it is a blow to Shiina, an engineer who left his job as a Digital Equipment Corp. representative in Japan to start Sord in 1970. Company sources say Shiina's inability to delegate authority is a major reason why Sord ran into serious trouble.

Undercapitalized. But that alone may not have been fatal. Industry analysts say an even more serious Sord weakness was its lack of financial resources. With the company capitalized at $10.8 million, Shiina planned to sell further shares on the Tokyo Stock Exchange last year, but had to give up his plan in the face of Sord's dismal performance.

Giants such as NEC Corp. and Fujitsu Ltd. moved aggressively into the small-business-computer market in the early 1980s, slashing prices to increase market share. Sord was forced to cut its prices to compete, and profits eroded.

Although Shiina and his engineers developed an in-house software package for business applications called PIPS (Pan Information Processing System), he stubbornly refused to adopt IBM-compatible software. This, too, hurt his marketing efforts.

Sources close to the negotiations say that Shiina and other top executives will remain at Sord after the expected accord takes effect on April 1. But one company insider revealed that at least one top executive—and maybe more—will resign. "I cannot imagine Shiina himself staying around long under these circumstances," he added. –**Michael Berger**

News briefs

IBM supports AT&T's Unix across 370 line

Tucked away in the pile of announcements that accompanied IBM Corp.'s Sierra mainframe release last month was an interesting item for the Unix world. Under a list of VM-system software enhancements was something called the IBM Interactive Executive for System 370. That turns out to be an IBM-supported Unix System V with a number of IBM enhancements for use across the System/370 processor line. The IX/370, as it is called, runs as a guest under the IBM proprietary operating system VM/SP Release 3.0. It marks the computer giant's first support of the Unix version that AT&T Co. is trying to make into a standard (see related story, p. 47).

Asea, Seiko in robot agreement

Sweden's Asea AB and Japan's Nitto Seiko have signed an agreement giving the Swedish firm worldwide distribution rights—and exclusive European sales rights—to a new range of Scara assembly robots. The Scara robot has become a leader in assembly jobs since its introduction in 1981. The robots covered by the agreement are new all-electric, servo-controlled, jointed-arm models developed from Asea specifications. They are designed primarily for simple insertion tasks. This is the first agreement with an outside robot maker for Asea, the largest robot maker in Europe. (It claims to have 30% of the European market). Asea is making major marketing efforts in the U.S., where it has a 10% market share, and in Japan, where it has 4%.

IBM, AT&T, Toshiba detail 1-Mb chips

It had one before, but now it has a better one, IBM Corp. says. The better one is a new 1-Mb memory that the company is making using existing production lines at its plant in Essex Junction, Vt. IBM says the chip operates at 80 ns, though initial samples have run at 60 ns. An IBM representative notes that the chip, which measures 5.5 by 10.5 mm and has 1 μm-design rules, is "significantly smaller and faster than the megabit chip announced by IBM last year." Not to be outdone, AT&T Co. says its megachip measures 4.8 by 14.5 mm, with a design rule of 1.3 μm. Its access time is 80 ns. Toshiba America Inc., the U.S. unit of Japan's Toshiba Corp., says it has a 1-Mb CMOS dynamic random-access memory with an access time of 100 ns.

Shannon to receive Interface award

Claude E. Shannon, often called the father of information science, will be given the 1985 Interface Award for extraordinary achievement in data communications this week at the Interface '85 conference in Atlanta. While working at Bell Laboratories in 1948, Shannon derived a formula for estimating the maximum data rate possible over voice-grade phone lines, thereby laying the groundwork for much of today's communications theory. He taught at the Massachusetts Institute of Technology from 1958 to 1980. The Interface award is presented annually by the editors of *Data Communications* magazine and the Interface Group. Past recipients of the award include Robert Metcalfe for his work in local-area networks, and Lawrence Roberts for his theories of packet-switching technology.

Brazil moves to protect local CAD/CAM vendors

Eight Brazilian firms are seeking government permission to import foreign computer-aided design and computer-aided manufacturing technology under agreements that will give them a captive market for eight years. The companies have negotiated contracts with foreign suppliers and are now awaiting the go-ahead the Special Secretariat for Informatics (SEI), the government body that controls the computer sector. The SEI hopes to announce its decision by March 15, the day that the country changes government. Among the U.S. CAD/CAM suppliers are Hewlett-Packard, Intergraph, Calma-General Electric, and Computervision.

MASK ROM RIDES AGAIN

A battered casualty of the video-games retreat, nonvolatile read-only memory is coming back in different guises

☐ *by J. Robert Lineback*

Dallas

Nonvolatile mask ROMs are anything but the explosive semiconductor business once enjoyed by memory makers in the early 1980s. Back then, read-only memories were one of the few bright spots in a bleak chip market as electronic video games dazzled both consumers and ROM merchants with plenty of fast-paced action.

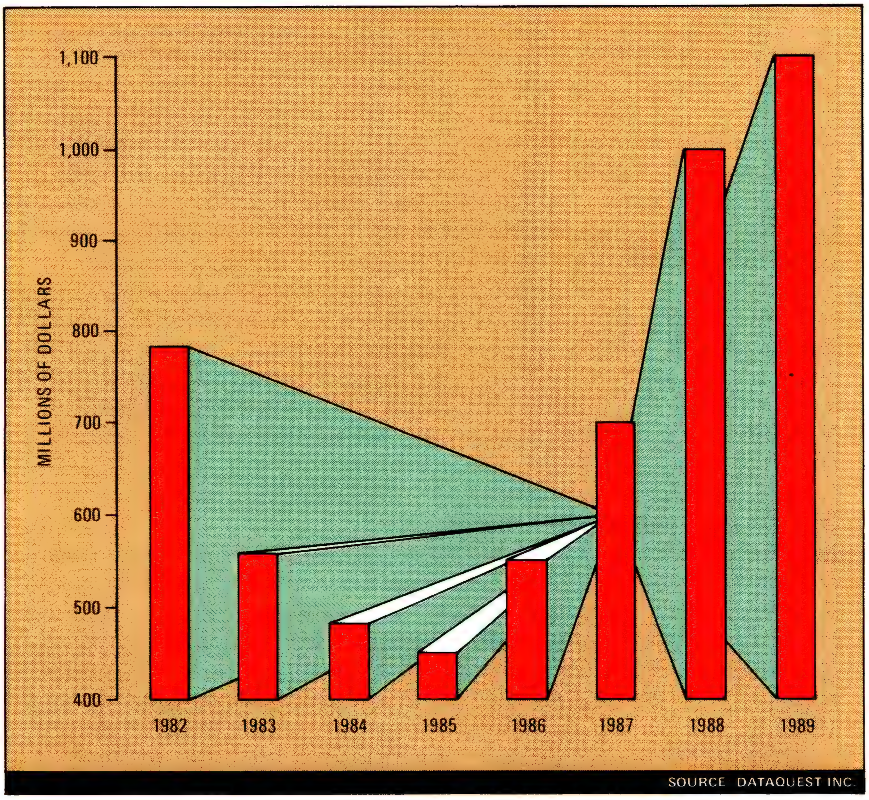
Three years after the bust of the video-game boom, ROM manufacturers around the world now hope to rekindle new growth in a still-sagging nonvolatile-storage market by offering megabit-density chips, new pinout configurations that closely couple programs to popular microprocessors, and much higher speeds. Some vendors are even seeking out yet-unheard-of software applications for personal computers.

According to the latest estimates from Dataquest Inc., 1985 ROM markets will be in the dead center of a dollar-shipments trough dug at the collapse of the video-games business. The market research firm projects strong growth for the last half of the decade, however, with sales rising from $450 million in 1985 to $1.1 billion in four years (see chart).

Dataquest estimates that at the height of the video-game craze, some 50 companies pursued the market for ROM cartridges. Today, it says only 15 are actively seeking new sales in the shrinking video and home-computer niches. The most visible casualty of the video-game crash has been Synertek Inc., the Honeywell Inc. subsidiary that laid off 1,000 workers and shut down plants in California two months ago. Others, such as Rockwell International Corp., are de-emphasizing commodity ROMs. National Semiconductor Corp. dropped ROMs from its portfolio in the summer of 1983.

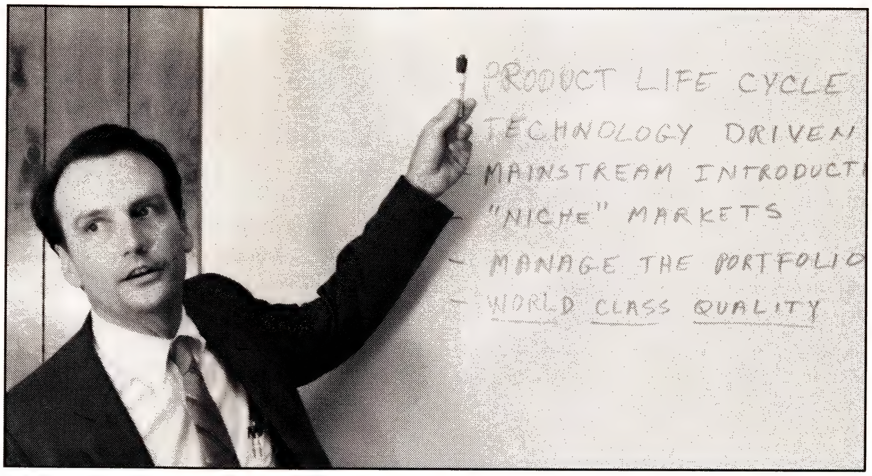
Many, however, are attempting to reposition ROM technology for computer and industrial markets. Nearly all believe that ROM competition will be as strong or greater in the coming years. But while ROM makers try to reposition chips, prices of existing products continue to be extremely soft. Many 64-K ROMs that sold for $3 to $4 a year ago are now priced as low as $1.50.

From chomps to crunches. With the ROM market no longer animated by electronic creatures chomping their way through video mazes, growth is expected to come from new ROMs aimed at the much larger



SOURCE: DATAQUEST INC.

Climbing out. This year, ROM sales will be dead center in a dollar-shipments trough caused by the video-games collapse. But manufacturers hope to rekindle strong growth by decade's end.



Eclipse. Jack Morgan, director of MOS memory marketing at Motorola, expects mask ROM to become more of a minor player as the cost of EPROM technology closes in on it.

appetites of fast, number-crunching microprocessors that do their work 16 and 32 bits at a time. To keep these fast parts busy, new high-density ROMs are beginning to now tout speeds below 150 ns, compared with access times well over 400 ns for many video-game machines.

While ROM processing technologies push chip densities beyond 1 Mb and per-bit prices lower, erasable programmable ROMs continue to make strong inroads into volume applications once served only by mask-programmed memories. Traditionally, the smaller-density ultraviolet-light EPROMs have been used as prototyping vehicles to make sure all glitches are out of the code. Once programs are debugged and tweaked, code is usually fixed into larger and often more stable ROM components.

New fear. Ironically, megabit densities of next-generation ROMs are causing many customers to be less willing to firmly set codes in silicon, say some market participants. Many customers fear that programming errors or minor changes in software will render thousands of huge custom memories useless.

"There is definitely a need for more bits, but the question is becoming what size is the best chunk to do it in," notes Mike Harris, marketing manager for ROMs at Advanced Micro Devices Inc. "Will a 4-Mb ROM be better than four 1-Mb chips? I think a lot of people might elect to go with four different chips because if there is a change, it will be much easier to accomplish. But again, it will depend on the customer, and I'm sure the industry will have the answers when we get there."

EPROMs are also becoming more available in low-cost windowless plastic packages as one-time field-programmable ROMs. One-time programmable ROMs, however, are still priced too high and in too short supply to offer a serious threat to masked ROMs, many believe.

Intel Corp.'s Richard Immekus, product line manager for commodity EPROMs, estimates only 5% of the chips shipped in 1984 were in plastic packages. "It's not so much that they are not catching on, but it is from a supply side," he adds. Part of the delay involves new testing procedures. One-time programmable EPROMs require testing prior to packaging. Patterns cannot be erased once the chips are housed in windowless packages.

"Mask ROMs, of course, are not dead, but we are expecting them to be more of a minor player because of the evolution of EPROM technology," says Jack Morgan, director of MOS memory marketing at Motorola Inc. "What is happening is that EPROM technology is getting closer to ROM technology from the standpoint of total costs—that is, the tooling charge, lead-times in having parts made, and the risk of dollars associated with what I'll call the whoops factor, which happens whenever new software may not be just right." In the ROM business, cancellation charges are often equal to the entire purchase price of a lot of in-process chips, adds Morgan.

Consequently, ROM vendors are feeling additional pressures to give customers more flexibility and programming time by delaying customization steps until the last mask layers are in production. Several manufacturers are considering a combination of ROM and electrically erasable PROM on the same chip to allow some minor changes in the code through the product life of a system design. Motorola already markets such a product. Still, when it comes to unchanging programs, high-density ROMs are still expected by many to reign as the low-price champion for the foreseeable future.

"I would still say the No. 1 issue with everyone is price," says Sam Stewart, strategic marketing manager at American Microsystems Inc. "If your code is reasonably stable, you can still do it in a ROM several times cheaper than you can ever do it in an EPROM."

For the most part, ROMs are likely to be the memory chip of choice to handle unchanging software-control jobs, such as basic input/output schemes to interface hardware peripherals to operating systems, and character generators for video displays as well as printers. Such is the case with huge ROMs in Japan, where memory makers bear an extra incentive for higher density—to handle complex kanji character sets.

A number of megabit ROMs are already in volume shipments from Japanese silicon houses, including a by-12-bit 1.2-Mb ROM from NEC Corp. The firm is marketing it as a two-chip set for kanji-character generation. NEC officials estimate that more than 80% of Japanese high-density ROMs are used for kanji generators. It also markets 1-Mb chips for printers and displays. A 2-Mb ROM, with 200- to 250-ns access times and featuring both by-8- and by-16-bit configurations, is now under development.

At the height of the video-game craze, some 50 companies pursued the market for ROM cartridges; today, only 15 are active.

Toshiba Ltd., which places the Japanese ROM market at one sixth the size of the U.S. business, is also selling most of its megabit chips as kanji-character generators. But in the U.S., the firm believes most megabit chips will be used for software. Hitachi Ltd. is cranking out 1-Mb ROMs using error-correction coding to boost yields in its CMOS process and is now considering a 2-Mb ROM.

In Japan, the ROM field continues to grow, with a number of small startups entering the business. Participants also include the likes of Oki, Mitsubishi, Fujitsu, Matsushita, Suwa, Sharp, and Nippon Gakki (Yamaha). Most believe 16-Mb ROMs are in the offing. That density will likely require three-dimensional integration along with geometries smaller than 0.5 µm. Eventually, Toshiba officials expect to offer by-32-bit ROMs for the emerging 32-bit microprocessors, eventually reaching density levels of 32 Mb.

New generation. Most ROM vendors believe the 1-Mb generation opens up a whole new realm of embedded application computer software, such as older well-established office programs, spelling checkers, dictionaries, and some high-volume expert-system knowledge bases. "For a while, it looked like all you were going to be seeing were kanji-character generators," adds American Microsystems' Stewart, referring to the pressing need for high-density ROMs in Japanese computer markets.

At Mostek Corp., ROM marketing officials also believe that the emerging megabit-density generation opens up a whole new era of growth for mask memories. "From the applications point of view, what happens at 1 Mb [chip densities] and above is that suddenly application software packages typically residing on floppy disk can now be integrated on the ROM," states Peter Richmond, Mostek's marketing manager of semicustom chips.

Growth is expected to come from new ROMs aimed at the appetites of fast microprocessors working 16 and 32 bits at a time

The firm has begun shipping the first samples of its 1-Mb MK3901. Slated for production deliveries in the third quarter, the 1.5-µm n-MOS chip is one of the first so-called wordwide megabit memories on the market with the capability to deliver software 16 bits at a time to 16-bit microprocessors.

The 3901 is housed in 28-pin dual in-line package and features a multiplexed data-and-address scheme. The multiplexed pinout, along with a second 40-pin nonmultiplexed data-and-address package, recently won approval by the 43.2 memory panel of the Joint Electron Device Engineering Council. Both proposals are expected to win full Jedec approval by summer.

Pin debate. Generally, manufacturers are lining up in either the 28-pin or 40-pin camps for by-16-bit megabit ROMs. Those favoring the smaller multiplexed package say it saves printed-circuit board space and is more tightly coupled to buses of several popular 16-bit microprocessors, such as Intel's 8088 and 8086 chips, which both have multiplexed data and address.

Backers of the 40-pin package say multiplexing will present contention problems on high-speed buses. The nonmultiplexing scheme also is more in line with the 68000 family of microprocessors. Others argue that space-saving chip-carrier packages are also expected to reduce advantages of the 28-pin configuration.

With 1-Mb chip densities, two ROMs can hold the software for the popular Lotus 1-2-3 integrated package of application programs from Lotus Development Corp. "That means, in theory, you could do away with a whole disk-drive package and some of the RAM used to download programs from disk. Now, you can access ROMs directly by microprocessor," suggests Mostek's Richmond. "It triggers a whole new aspect to integrating personal computers and systems of that size."

Analyst David Wilson, head of the IC Division at Future Computing Inc., doubts that ROM-based application-software packages will greatly reduce the use of floppy disks in personal computers. But he does note that ROM-based Lotus 1-2-3 running in IBM Corp. PCjr systems (with additional RAM) can run a larger spreadsheet model than IBM's more powerful Personal Computer business models. That's because applications software from disk must be loaded into the system's RAM, taking up potential user memory space.

"But disk prices are still coming down, and there will be less and less of an incentive to go to ROMs, because floppy disks are cheaper—$1 to $2 to the manufacturer—and like EPROMs, you still get shorter lead times and greater flexibility in putting code into them," he says.

Megabit densities of upcoming ROMs are causing many to fear that program errors will render thousands of custom memories useless

At General Instrument Corp.'s semiconductor operation, the video-game market of the early 1980s was a major buying segment of its components. When demand plunged, General Instrument, like most other ROM suppliers, began shifting its emphasis to data-processing applications with higher-performance, high-density chips. After sampling an experimental megabit ROM to some customers last summer, the company is now preparing to introduce a totally new chip later this year using 2-µm n-MOS and complementary technology, says Ken Greenberg, vice president of marketing for the firm's Microelectronics Division.

Still loved. "The ROM business obviously had an abnormal glitch in its life cycle during the growth of video games. Most products don't behave like that," says Greenberg. "The fundamental issue is that ROMs remain very important to microprocessor systems. There will be things, however, that cause us to look at them differently as technology converges. The megabit density level of ROM is changing ROM applications in systems.

"It will take a lot of convincing to get engineers to commit to a megabit of code into memory. It's clearly an emotional hurdle," he continues, suggesting that data-oriented programs, such as spelling checkers and embedded dictionaries, will likely be among the first software used in large ROMs. "There are not that many bugs in a dictionary or speller checker, hopefully." □

EDS '85:

INVEST 3 DAYS TO MAKE THE OTHER 362 PAY OFF!

1985 ELECTRONIC DISTRIBUTION SHOW AND CONFERENCE

Tuesday, Wednesday, Thursday—April 30, May 1 and 2, 1985
Hyatt Regency Hotel, Chicago, Illinois (downtown)

Exhibit Hours: 9:00 a.m. to 5:00 p.m. (3:00 p.m. on Thursday)
Seminars begin Monday, April 29

EDS '85 lets you meet with your present vendors, acquire new lines, solve problems, and chart your future success—*all at one time and in one place!* And now there's even more to look forward to at your industry's national meeting place and marketplace...

- MORE EXHIBITS!

Over 300 major manufacturers and suppliers showcasing:

- Components
- Instruments
- Accessories
- Hardware
- Equipment

PLUS... special display area showcases the NEW products at EDS—new items, new sources

- TOP MANAGEMENT CONFERENCES

EDS is a "must" event for top-level managers from the top companies in distribution... for one-on-one private conferences on strategy, market analysis, problem-solving and more.

- TECHNOLOGY UPDATE!

Special Advanced Technology Center—new at EDS '85—features products and trends that are shaping the future, presented by the industry experts on the leading edge of these advancements:

- Gate Arrays/Standard Cells
- Surface Mounted Technology
- Fiber Optics and Interconnect
- Electroluminescent Displays

- MORE SEMINAR SESSIONS AND WORKSHOPS!

Your #1 source for usable, in-depth industry information sessions for both top and middle management personnel. Topics include:

- Market Outlook: 1985 Update
- Marketing Management
- Incentive Compensation
- Distribution of Computer Components to the OEM
- Developing & Marketing Value-Added Services
- Maximizing Productivity
- Effective Inventory Control

Don't miss out on the exciting opportunities that are waiting for you to claim them at EDS '85! *And remember to plan your participation*... a little time invested in advance planning and appointment-making can reap big rewards in post-EDS profits!

- CONVENIENT CENTRAL LOCATION!

1985 marks EDS' return to Chicago—a dynamic, vibrant city that offers world-class amenities, as well as easy access from anywhere.

To receive an application for FREE admission to the exhibits, contact:

ELECTRONIC
INDUSTRY
SHOW
CORPORATION

222 South Riverside Plaza,
Suite 2710
Chicago, Illinois 60606
Phone: 312/648-1140

Circle 37 on reader service card

ElectronicsWeek
Special Report: April 1

For Space
Reservations
Call: Production Department
(212) 512-3140

Wafer Scale Integration

No one has been able to consistently provide integrated circuits on a whole wafer. Yet a number of companies are dedicated to achieving the speed and reliability advantages it offers.

What *is* the market potential and who are the players? Is a breakthrough around the corner? These and other answers to questions on wafer scale integration in this report.

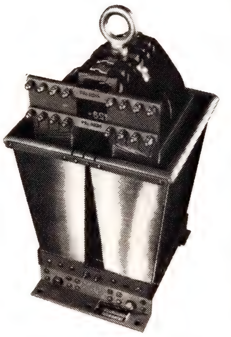
Issue Date: April 1
Closing for Advertising: March 11

ElectronicsWeek
The Magazine of the Worldwide Electronics Industry

PEARSON

Very High Voltage &
Very High Current

Pulse Transformers



Pearson Electronics specializes in the design of very high voltage (to 1,000,000 volts) and very high current (to 1,000,000 amperes) pulse transformers. Typical applications are for units supplying power to high power microwave tubes, particle accelerator injection systems, pulsed x-ray tubes, high power lasers and plasma physics.

Other Pearson pulse-modulator components include precision current transformers and coaxial capacitive voltage dividers. The current transformers for high voltage use feature double shielding and high voltage stand-off capabilities. Units for use with high currents are rated up to 1,000,000 amperes or more. The voltage dividers are rated up to 500 kV.

Inquiries regarding specific requirements for these components are welcomed.

PEARSON ELECTRONICS, INC.
1860 Embarcadero Road, Palo Alto, Calif. 94303, U.S.A.
Telephone (415) 494-6444 Telex 171-412

Ever notice how some people always seem to have the right answer? No matter what the situation, they always seem to be a step ahead.

And they're successful...the first in line to lead an important project...the first in line for a promotion. It's certainly not magic. Usually it's a combination of hard work, brains, guts and desire.

It probably means they read ElectronicsWeek... regularly.

ElectronicsWeek has helped propel many a manager and engineer to the front line...to the "leading edge" of the industry. And just as we've been providing many of your colleagues with the right information, the *important* information—when they need it most—so too can we provide it for you.

Every week an ElectronicsWeek subscriber receives an issue crammed with the latest information on new products, developments, concerns and trends in the worldwide electronics industry.

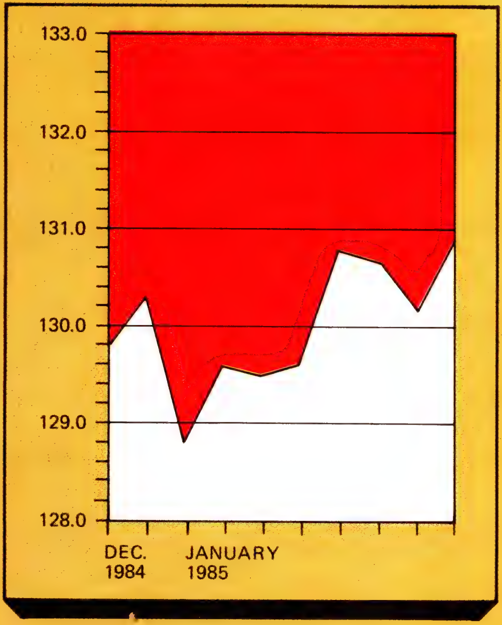
When you become a subscriber, we'll supply you with the intelligence you need to make the big decision, or the every day decision to further your career and reap profits for your company. For a taste, just browse through the issue you're holding.

But, you really don't have to believe us. Just ask the person who's always a step ahead.

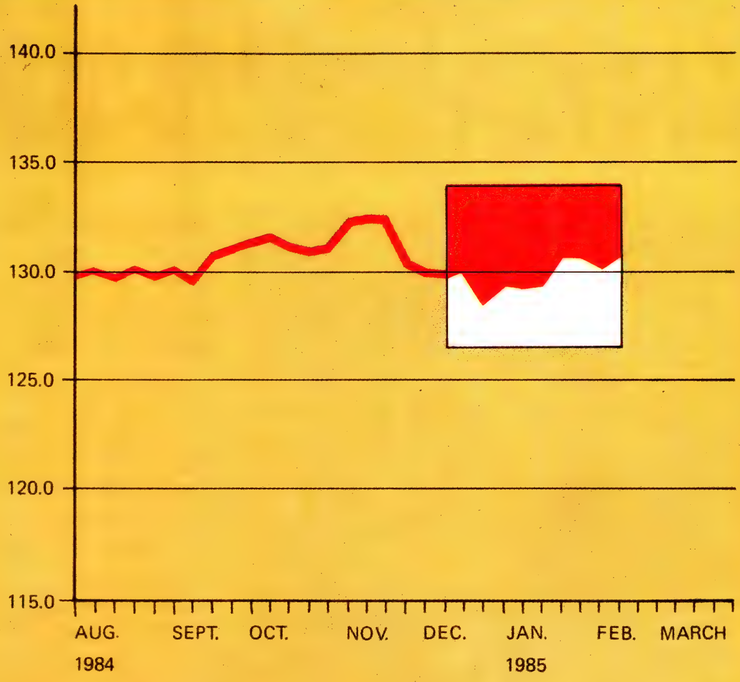
To become a subscriber, just complete and mail the insert card in this magazine. If subscription card is missing, write: Circulation Manager, ElectronicsWeek, P.O. Box 511, Hightstown, N.J. 08520.

ElectronicsWeek
The Voice of the industry

ElectronicsWeek Index



THIS WEEK = 130.9
LAST WEEK = 130.2
YEAR AGO = 119.0
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. INDUSTRIAL PRODUCTION INDEX

	December 1984	November 1984	December 1983
Office and data-processing equipment	356.5	345.3	300.8
Communications equipment	224.3	217.9	186.6
Radio and TV equipment	112.9	109.2	110.0
Electronic and electrical instruments	182.4	177.5	164.6
Components	450.9	450.6	401.0

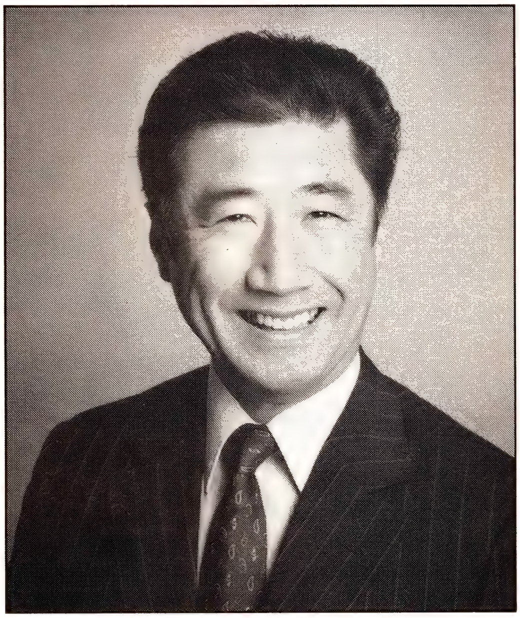
The first across-the-board increase in the production of electronics equipment since February of last year helped push the *ElectronicsWeek* Index up by 0.5% last week. The biggest winner was the radio and television industry, which saw its production levels gain 3.4%. Electronic office equipment and computer production, which had floundered since midsummer, also rose 3% in December, according to the government's latest statistics. The output of instruments and communications equipment, less boisterous but strong nevertheless, rose about 2.8% in the period.

Elsewhere in the economy, general industrial production edged up a bit, while the trade situation eased somewhat. Imports receded slightly and exports increased a bit, both inside and outside the electronics industry.

What the rest of 1985 holds for the electronics industry may be a different story, however. The U.S. dollar continues to strengthen, reaching new heights against major world currencies. Hence the force that gave the U.S. electronics industry its first annual trade deficit in 1984 will continue to batter U.S.-made electronics goods abroad for some time to come. On home soil, U.S. electronics firms will have to contend with an inundation of foreign-made goods.

The U.S. dollar aside, electronics producers could have a good year ahead. With the pickup in the general economy, things should only get better. Consumers continue to spend freely, and producers of consumer electronics products should benefit. But as exhibited by Intel Corp.'s recent layoff of 900 workers, the semiconductor industry's woes continue. One positive note: the semiconductor glut is so bad that cheap imported chips have not been able to break any new ground in U.S. markets.

YAWATA USES HIS OPTIONS TO START UP A JAPANESE FIRM



History-maker. "KK" Yawata heads Nihon LSI Logic, an affiliate of LSI Logic Corp. in the U.S. He believes Japan is ripe for venture capital investments in startups.

Tokyo

Keiske Yawata made a kind of history by becoming one of the first Japanese to leave a "lifetime" job to start his own company—and one affiliated with a U.S. firm to boot. He had spent 26 years with NEC Corp. in a variety of positions.

Yawata believes the time is ripe for venture operations in Japan. "There is a tremendous accumulation of capital in Japan—in banks, postal savings deposits, and life insurance. We had no trouble raising the initial $20 million."

Hiring with options. But bolting NEC to start up Nihon LSI Logic was only the warmup for Yawata's much more daring plan: the introduction of a hiring incentive that is unknown in Japan—the stock option. Yawata, 50, learned the value of the option as a recruiting tool when he came to Silicon Valley in 1981 to organize NEC Electronics Inc. (now NEC's U.S. semiconductor operation). He found it difficult to compete for engineering and managerial talent against new companies funded by venture capitalists.

After talking to experts in the venture capital business, Yawata met with Wilfred J. Corrigan, a veteran semiconductor executive whom he had known since Corrigan's days as president of Fairchild Camera & Instrument Corp. in the 1970s. Ousted as president of Fairchild when it was purchased by Schlumberger Ltd. in 1979, Corrigan founded LSI Logic Corp. and caught the wave of application-specific integrated circuits. Last year, LSI Logic reported revenues of $84 million, and Corrigan wants to develop it into a billion-dollar company by the 1990s.

A year ago, Corrigan raised £15 million from British investors to start a European affiliate, LSI Logic Ltd., of Bracknell, UK.

Nihon LSI Logic is Corrigan's second such venture. Banks, insurance companies, and individual investors in Japan put up 4.5 billion yen (about $20 million) for a 30% interest in the local venture. Parent company LSI Logic, which provides the technology, owns the rest. Yawata will offer some of that equity as stock options to potential employees so that he can attract a good staff.

On the wanted list. "I've known for a long time that I wanted KK [Yawata's U.S. nickname] for this job," Corrigan says. "Nihon LSI Logic will be a real Japanese startup, a freestanding company, and I felt it was important that KK be the one to do it. He understands better than other Japanese the whole mechanism of starting a new company. He knows both the Japanese culture and the Silicon Valley culture. Essentially, he will clone our company and add Japanese genes to it."

Nihon LSI Logic has already booked its first dozen designs, which will be developed at a design center in Tokyo and fabricated at LSI Logic in Milpitas, Calif. Yawata plans first to expand the engineering staff. Then he will seek a site far from Tokyo for a manufacturing plant.

Eventually, the company will be offering shares to the public, and LSI Logic itself may become a minority shareholder. **–Clifford Barney**

WHAT'S IN A NAME? FILENET'S SMITH KNOWS IT COULD BE DOLLARS

Costa Mesa, Calif.

One tip-off tells an entrepreneur he is breaking new ground: standard jargon can't describe his product. Theodore J. Smith, president of FileNet Corp., found himself with this kind of marketing problem late last year, while hawking his company's new optical-disk storage-and-retrieval library.

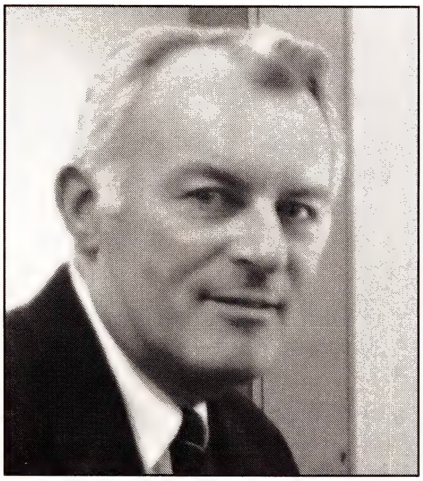
Featuring a document-image processor and linked to mainframe computers, the equipment is designed to eliminate office paperwork, says Smith. Through the use of scanners, data is entered onto nonerasable optical disks. These optical scanners can handle any type of material—including typed or handwritten documents, and drawings. Each disk holds 1 gigabyte per side, and there are 64 disks in a full library.

Despite the system's appealing promise, Smith needed a new marketing approach to get his message across. The trouble was that the blend of optical and computer technology "went so far beyond usual data-base retrieval that it needed new terminology," he recalls. So he and his marketing force at FileNet came up with terms such as "image-base management"—and drew large audiences at sessions across the country.

Closely watched. Prospective users are not the only ones who are watching FileNet closely, however, since the firm, founded by Smith in 1981, is probably the first in the U.S. to manufacture and market optical-disk-based gear. Because the sale of optical-disk-based information systems is expected to become a major business in a few years, FileNet's success or failure will influence other companies looking for a market to target.

Being first with a product is nothing new for Smith, 56, whose smooth presentation and trim appearance would qualify him to do his own television commercials. As president and chief executive officer of Basic Four Corp. in the late 1970s, the silver-haired executive led that computer firm through several microcomputer innovations. Earlier, Smith was executive vice president at Sycor Inc., which was in the forefront of intelligent terminals and distributed processing.

This experience taught Smith how to get the word out; the company says it has more than 5,000 inquiries about the system, whose base price is $278,000 for two work stations, scanner, laser printer, optical disks, and file server. Smith calls this price "a bargain, because people expected it to cost $1 million." FileNet expects to start making deliveries this spring.



Paper chaser. Theodore Smith of FileNet says his company's optical-disk storage-and-retrieval library eliminates office paperwork.

Still operating on the $16.7 million proceeds of two venture capital financing rounds and anticipating a third round of financing soon, Smith thinks FileNet could reach the $100 million sales level within three years. "If it moves faster, we're geared to do that, too." –**Larry Waller**

TI's McDONOUGH CHIPS AWAY AT GRAPHICS MARKET

Houston

The big question in the [personal computer] business remains whether or not graphics at the home TV level will offer yet another pop [in demand]." Texas Instruments Inc.'s Kevin McDonough is referring to such inert but potentially huge consumer markets as videotex. "But there are no questions in the business segment," McDonough emphasizes. "Higher-resolution color graphics can make a big pop."

Drawing from a palette of new video graphics chips, McDonough wants to put some color into the lackluster personal computer business. The chips are part of a new-product thrust by TI's Programmable Products Division. McDonough, an 11-year TI veteran, became advanced development manager of this division two years ago. Last fall, he took on his new position as product manager of the specially formed graphics-products push.

In anticipation of the boom, TI has already unveiled a new graphics-processing architecture based on a special multiport memory. The memory is called a V-RAM, for video random-access memory. Although TI's MOS memory operation takes marketing responsibility for the TMS4161 64-K V-RAM chip, many of the new application-specific processors will be linked closely to the new video memory.

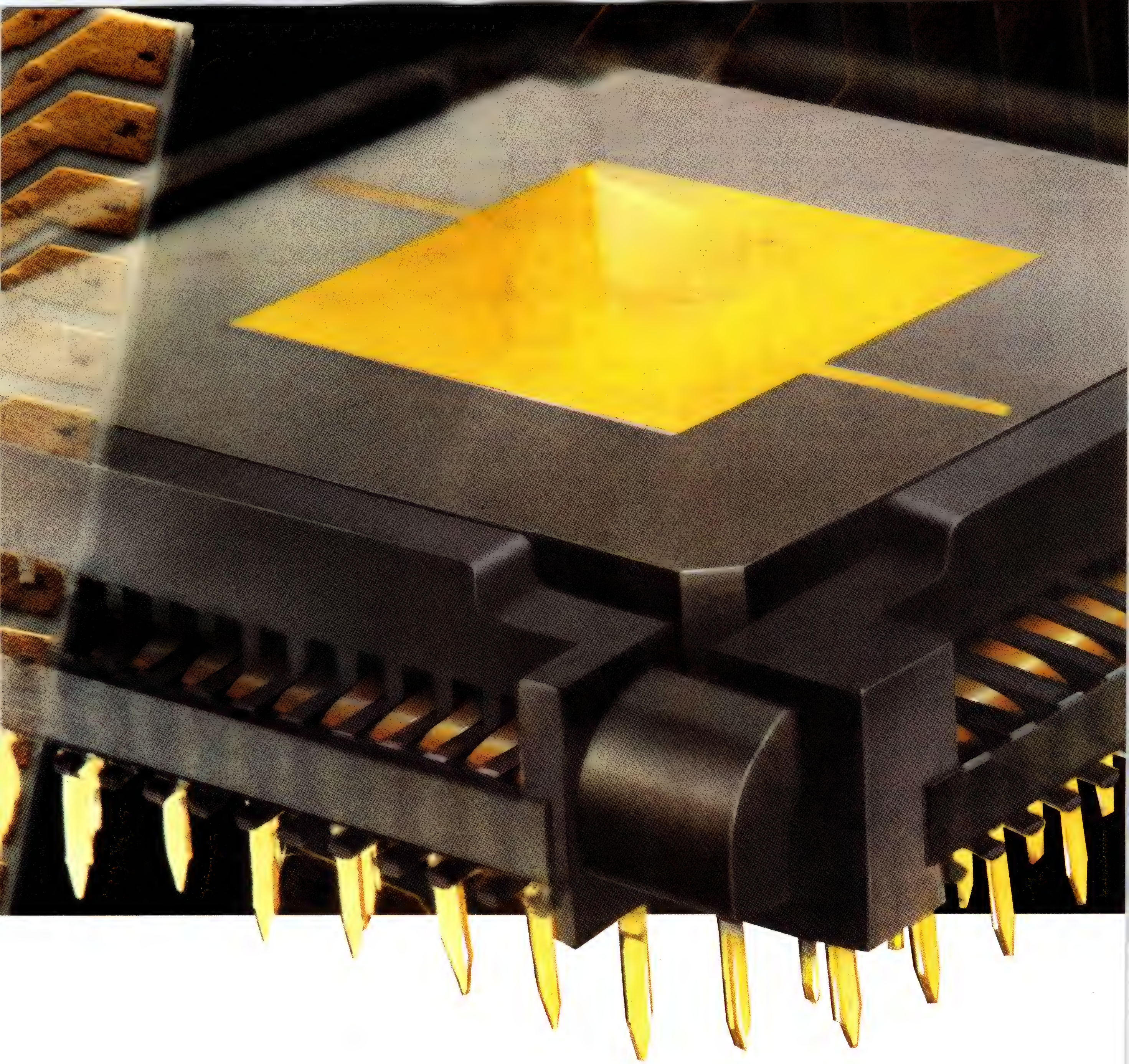
TI has already disclosed one such product, a video controller, though it is not yet on the market. This circuit will effectively double the power of host microprocessors by handling 95% of the overhead functions required in high-resolution bit-mapped graphics [*ElectronicsWeek,* July 30, 1984, p. 23].

"We realized that graphics, particularly bit-mapped graphics, was going to become a key requirement for personal computer work stations in the late 1980s. And the conventional memory is unable to keep the screen painted when you have to refresh it every 60th of a second," says McDonough, a 34-year-old native of Elyria, Ohio, who received his BSEE and MSEE degrees from Ohio State University.

Graphics leader. Predicting an inevitable migration to better color graphics, Kevin McDonough heads TI's graphics thrust.

Revolutionary. "That led to this revolutionary approach where we have designed the whole system, changing the memory devices and now interface components," he adds. To enhance the speed of future graphics controllers, TI is using reduced instruction set computer (RISC) architectures. "RISC machines are used in our TMS320 digital signal-processor line," notes McDonough.

McDonough sees a migration to more powerful color graphics as inevitable. "The real ability of graphics is to grab the user's attention. It is very tough for many buyers to appreciate the subtleties of a new multitasking operating system. But displays are easier to perceive as performance improvements at the point of sale." –**J. Robert Lineback**



Screening ideas for lower substrate-to-board interconnect costs?

Login with AMP chip carriers and sockets.

If you've been waiting for chip carrier technology to reach a more practical stage, it has.

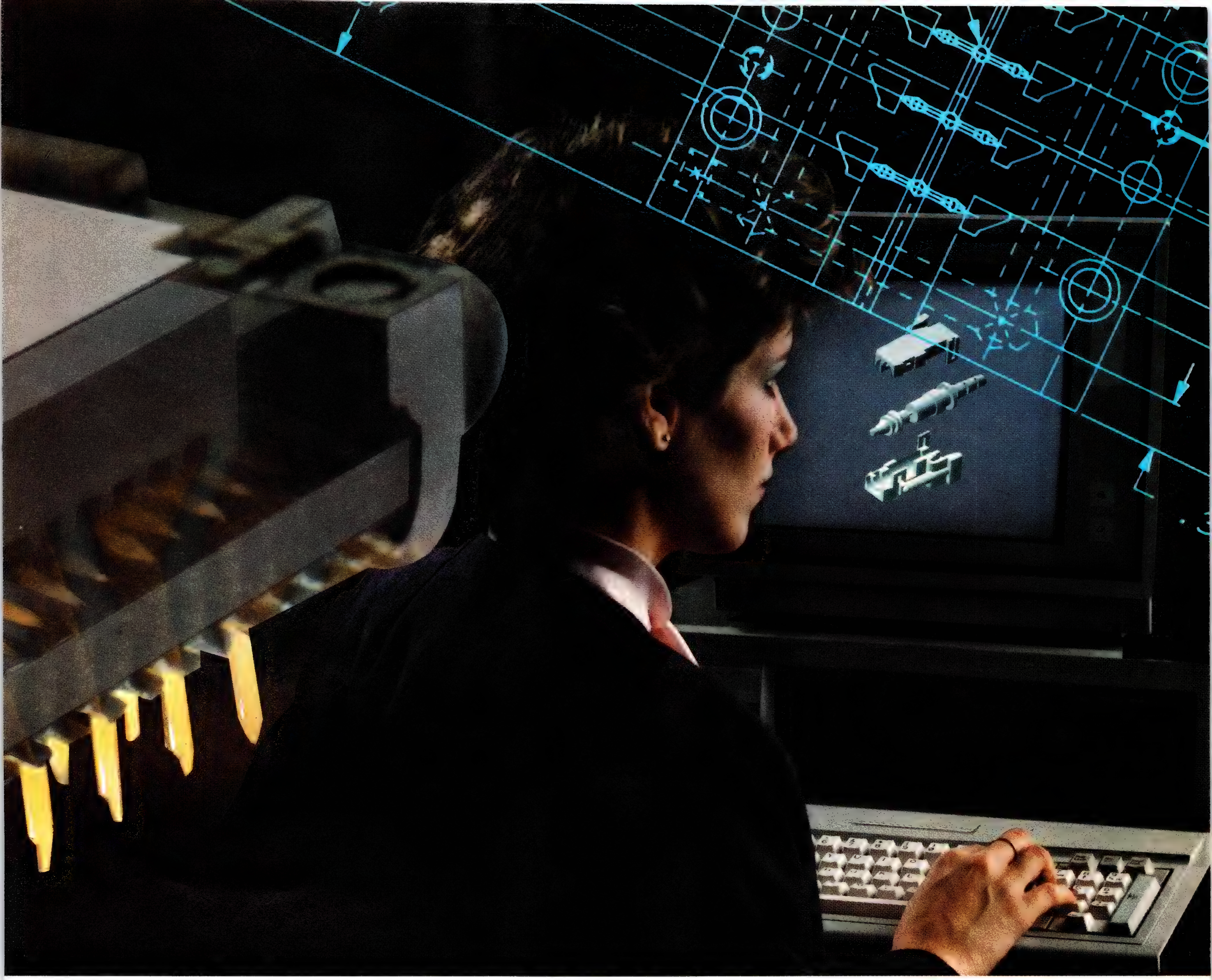
AMP low-profile sockets for plastic and ceramic chip carriers are now available at a surprisingly low-profile cost. In standard JEDEC sizes. In surface-mount or through-hole versions, with optional heat sinks.

Our ceramic chip carrier sockets feature duplex-plated contacts to eliminate solder-bath contamination. Plastic chip carrier sockets are available with gold or tin contacts, to match your requirements.

We even offer plastic chip carriers in a JEDEC Type A envelope, ready to run on your existing equipment.

And it's all available immediately, so you can make it part of today's design work. And move into production with assured reliability, assured economy.

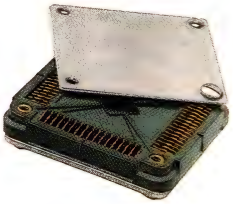
Find out more. Give us a call.



Ceramic Chip Carrier Sockets

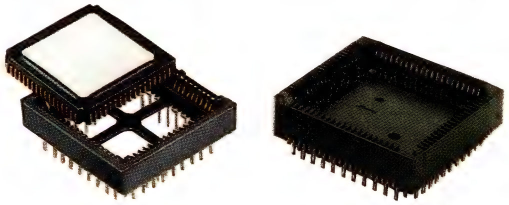
- JEDEC Types A, B, D
- Contacts: duplex plated

**Call (717) 780-4400
and ask for the AMP
Chip Carrier Socket Desk.
AMP Incorporated,
Harrisburg, PA 17105.**



High Speed Sockets, Surface Mount

- JEDEC Type A Leadless Ceramic
- Centerlines as close as 0.020″
- Contacts: gold,
  capacitance ~ 0.5pF
  inductance ~ 1.4nH



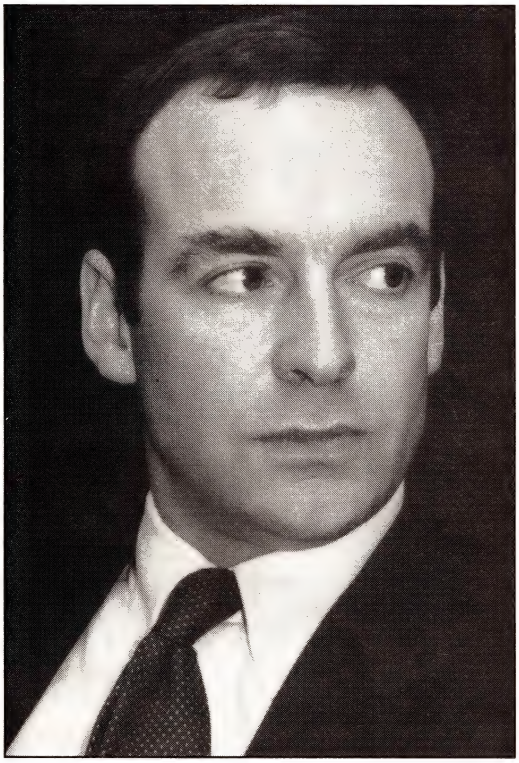
Plastic Chip Carriers and Sockets.

- Gold contact premolded carrier incorporates low inductance leads; permits cavity up or cavity down mounting.
- Gold contact sockets mate with AMP Chip Carrier or other leaded Type A devices.
- High-pressure tin contact sockets for JEDEC .050″ centerline plastic Chip Carriers.

AMP Interconnecting ideas

AMP is a trademark of AMP Incorporated

OLIVETTI PICKS UP BRITAIN'S FALLEN ACORN



Dividends. Dividing Acorn into units to focus on the education, scientific and industrial, business, and consumer markets will produce a leaner, more focused firm, says founder Christopher Curry.

Cambridge, England

Just six months ago, Acorn Computer Group plc, the British home computer maker, was flying high. In six years, it had grown from a two-man operation to a $96 million firm with international ambitions. Its meteoric rise had made it the darling of Britain's unlisted-securities market and had made millionaires—at least on paper—of its founders, Christopher Curry and Hermann Hauser. Yet recently, its shell-shocked founders, faced with liquidation, agreed to sell nearly half their firm to Ing. C. Olivetti & C. SpA for a mere $12.8 million.

Acorn had been hit by two swift disasters. First, its bid to enter the U.S. educational market was a $10 million disaster. Next, the fizz went out of the Christmas home computer market, leaving Acorn with a $7.6 million writeoff of unsold stock. All told, it lost just over $10 million in the six months ended Dec. 30, 1984.

The Olivetti connection may well turn out to be extremely beneficial for Acorn. The Italian computer and office-equipment maker has been making a practice of investing in high-tech startups. Among its U.S. proteges are Linear Technology Corp., a Silicon Valley chip maker; Stratus Computer Inc., a maker of fault-tolerant computers; optical-disk maker FileNet; and Docutel, which makes bank automation gear. It also has interests in several startups in Europe and Japan.

Aside from the cash, Olivetti has the muscle to take care of some of Acorn's marketing weaknesses. Acorn can tap Olivetti's overseas marketing setup through a new cooperation agreement. Further, some Acorn products might benefit from Olivetti's link with AT&T.

Highly regarded. For its part, Olivetti will gain access to Acorn's highly regarded—if loosely controlled—research and development operation, which has close links with neighboring Cambridge University. "We believe Acorn is a company with outstanding technical expertise," comments Elserino Piol, Olivetti's executive vice president for strategy and development. "With our backing, it will be in a strong position to establish an effective presence in worldwide markets."

While Acorn's high-tech reputation may have saved it from going under completely, slack management brought it to its current crisis. Things were fine for the company when the home computer market was booming. But when the going got tougher, Acorn's managerial weaknesses started to show.

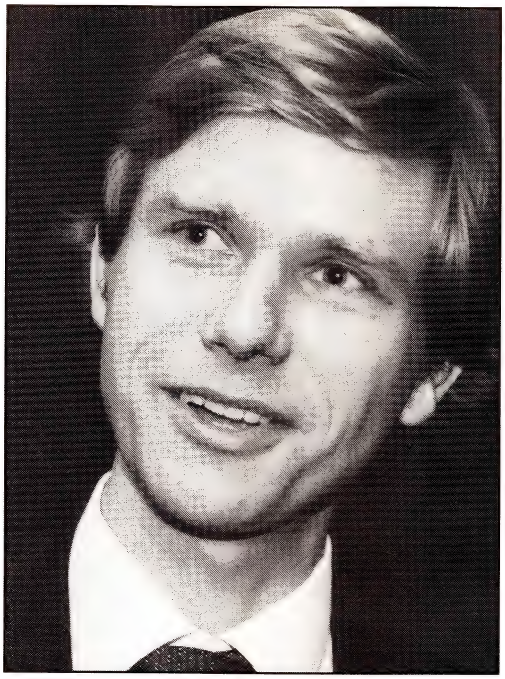
Curry, who handles day-to-day operations, has a keen eye for technology. But he has failed to manage that technology, industry observers note. New products have failed to come in on time. Marketing and sales weaknesses abound. For one, Acorn badly underestimated the cost of entering the U.S. educational market, and its relationship with its UK distributors has been poor.

New blood. Some of Acorn's management weaknesses were recognized earlier this year when the founders brought in Alexander Reid from British Telecom as chairman. Reid's first move was to cut Acorn's payroll by one fourth. The firm's expertise lies mainly in design and marketing, and like another British home computer firm, Sinclair Research Ltd., Acorn subcontracts all its manufacturing. So its payroll is almost entirely engineering staff.

Reid is also splitting the firm into four divisions—education and training, scientific and industrial, business, and consumer. The result, says Curry, will be a "leaner, more focused company."

Acorn may have survived a crisis, but it still faces some formidable challenges. Like its bigger U.S. rival, Apple Computer Inc., Acorn has relied for too long on a single product. The BBC Model B computer, like the Apple II, made its makers a fortune. Acorn won the contract to design a microcomputer for a computer-literacy project sponsored by the BBC in April 1981, against stiff competition. The $400 machine was a runaway winner. Until last Christmas, it still accounted for nearly 70% of Acorn's sales.

Acorn planned to take on the low-end sector with its $200 Electron. But the machine was late getting to market; once there, it faced stiff competition from Sinclair. Compared



Handwriting on the wall. A millionaire on paper, Acorn Computer cofounder Hermann Hauser saw the need to sell just under half the company to Olivetti for $12.8 million or face liquidation.

with the BBC computer, it has been a flop. Sales of these two machines were split almost equally among the educational, home, and engineering and business sectors.

The company's move into the business sector has also been tardy. Its ABC family of machines uses the basic BBC microcomputer architecture. This is now getting long in the tooth, say competitors, because it is built around the 6502 microprocessor.

But from the outset, Acorn wisely has built into its architecture all sorts of hooks to provide an upgrade path. The 6502-based front-end processor can connect to any of the industry's latest chips, including Intel Corp.'s 80286 and National Semiconductor Corp.'s 32016. Software compatibility is the bedrock of Acorn's product strategy, says Curry. This will apply to the replacement for the Model B, due this year.

Still a problem. Marketing is likely to continue to be Acorn's stumbling block as it enters the business market. Here, the Olivetti alliance may provide the ABC business computers, now coming off the production line, with more marketing muscle.

Acorn's strategy is to attack specific vertical markets, targeting such potential users as farmers, doctors, lawyers, and dentists. It is also developing a scientific work station, which will team the BBC computer with a National 32-bit microprocessor.

The company hopes to use its strengths to move into related markets, says Curry. Two new developments could push the firm into data communications. The first is a low-cost terminal that combines personal computing and telephony and could sell for around $600.

Further, Acorn is funding development of a chip set that implements a local-area network at Cambridge University. This highly modular ring-style voice/data network, with a 50-to-100-Mb/s data rate, could double as a private branch exchange. British Telecom is interested in the project. Acorn is also working with B.S.R. Ltd. on a compact optical-disk drive, to be made in Hong Kong.

– **Kevin Smith**

ACORN COMPUTER GROUP plc

Fiscal year	Sales (in dollars)	Profits (in dollars)
1979	28,500	2,760
1980	396,500	27,600
1981	1,251,150	150,870
1982	8,113,150	182,150
1983	38,965,000	4,068,000
1984	85,701,900	5,444,350
1985*	50,541,800	(10,058,900)

*Sales and net loss for first six months ended Dec. 30, 1984
Exchange rate: $1.087 = £1

SOURCE: ACORN COMPUTER GROUP plc

BOTTOM LINES

Mergers and takeovers up in 1984. Paced by General Motors Corp.'s acquisition of Electronic Data Systems Corp. for $2.5 billion and IBM Corp.'s takeover of Rolm Corp. for $1.26 billion, acquisitions and mergers in the software, services, and information industry hit a record $5.6 billion last year. The number of acquisitions and mergers jumped 80%, to 256 transactions from 142 such agreements in 1983, says the Cerberus Group Inc., which compiled the data. Of the total dollar amount of transactions in 1984, it says, "10 computing industry megadeals accounted for $4.855 billion, approximately 87% of the total value paid for all 1984 transactions."

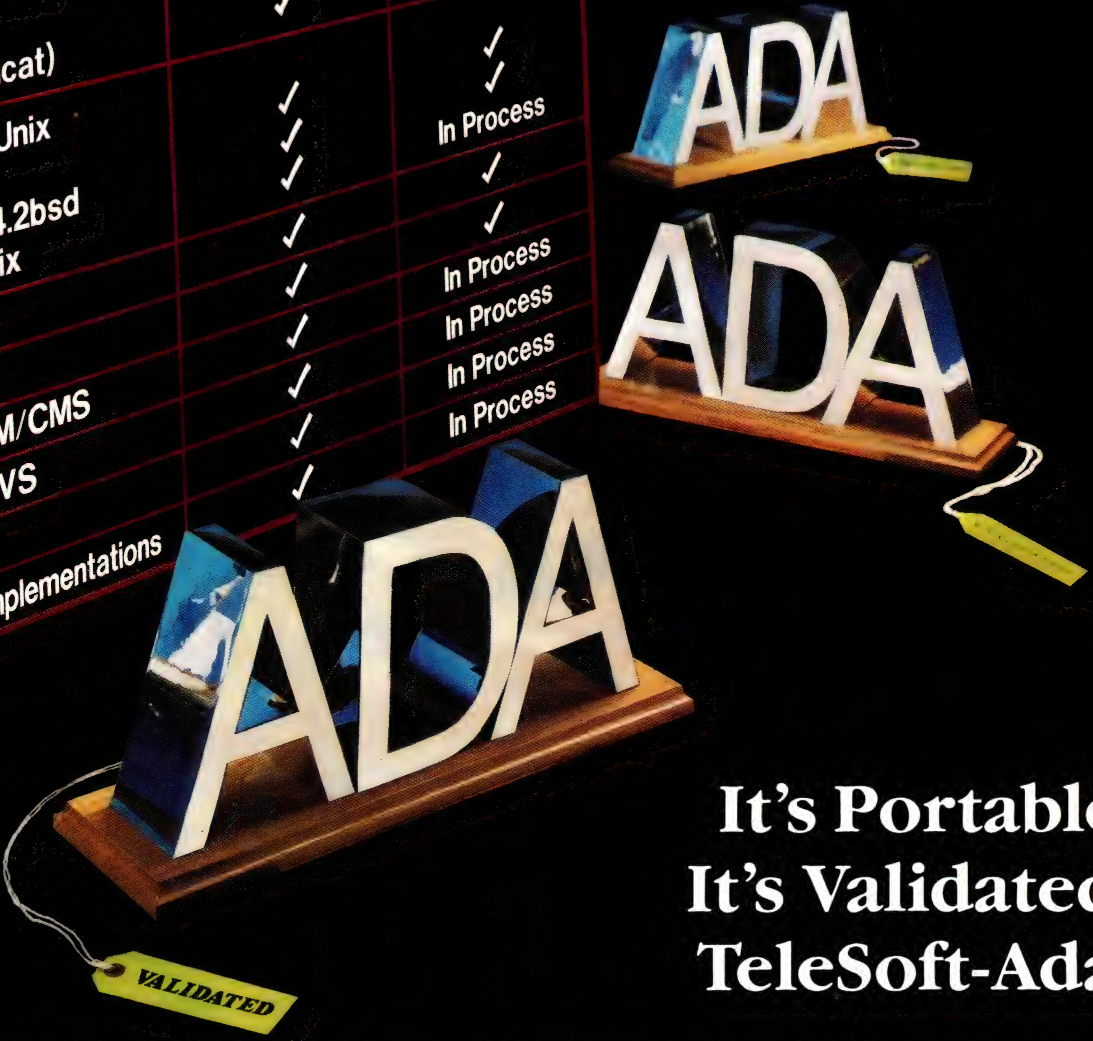
CalComp acquires Image Resources. The CalComp Group of Sanders Associates Inc. has acquired Image Resources Corp., a producer of high-resolution color business-presentation graphics systems, for $3.4 million. Image Resources will become CalComp Imaging Products. CalComp says the acquisition is the first step in its plan to build strategic partnerships in the computer and business graphics industry.

Amcodyne receives more financing. Amcodyne Inc., a maker of 8-in. fixed and fixed/removable Winchester disk drives, raised $8.4 million through a fourth round of venture financing. The firm will use the funds to complete installation of a volume-production process for its newer fixed-only drives. The new financing brings to $25 million the amount that Amcodyne has raised since its formation in 1981.

Cambex makes a deal with China. Cambex Corp. has agreed to ship up to $10 million worth of its computer systems to the People's Republic of China over the next three years. The first eight systems, worth $2.4 million, have already been shipped. Cambex will deliver more than 40 of its IBM-compatible systems under terms of the contract. The Cambex systems will be used for data processing and scientific computing in local government and university applications, the firm said.

Ada's First Family

Compiler	In Production Use	Validated
MC68000/ROS		
TeleSoft	✓	✓
Labtek (Wicat)	✓	✓
MC68000/ Unix		
System V	✓	✓
Berkeley 4.2bsd	✓	✓
Unisoft Unix	✓	In Process
VAX/VMS	✓	✓
VAX/Unix	✓	✓
IBM 370/VM/CMS	✓	In Process
IBM 370/MVS	✓	In Process
IBM PC	✓	In Process
Additional Implementations	✓	In Process



It's Portable.
It's Validated.
TeleSoft-Ada.

A growing company in San Diego has taken a giant step in bringing Ada to the software development world.

TeleSoft, the company that fielded the first Ada compiler and leads the market in user experience with over 450 installed, has validated the first in its family of portable Ada compilers.

TeleSoft's Ada compiler family is portable across most of today's popular host systems and development environments: MC68000/Unix, MC68000/ROS, Digital's VAX/VMS and VAX/Unix, IBM 370 VM/CMS and MVS. And development is well underway on Ada compilers for nearly a dozen other systems.

These compilers are all that Ada was intended to be: Truly portable, with complete support environments, and a clear growth path to exceptional compilation and execution speeds. TeleSoft has done this by developing technology which minimizes machine-dependent software and allows fast adaptation to new environments.

TeleSoft's announcement is the first big step towards a new era in the software industry—based on components, true software portability, and Ada standardization.

TeleSoft™

10639 Roselle Street · San Diego, Ca. 92121 · (619) 457-2700

Ada is a trademark of the Department of Defense; VAX and VMS are trademarks of Digital Equipment Corporation; UNIX is a trademark of Bell Laboratories; IBM 370, IBM PC, CMS and MVS are trademarks of IBM Corporation. MC68000 is a trademark of Motorola Corporation. TeleSoft-Ada is a trademark of TeleSoft. Copyright 1983, TeleSoft.

Circle 46 on reader service card

ElectronicsWeek

SPECIAL REPORTS

UNIX UPDATE: COMING OF AGE

The controversial operating system that programmers love and users hate is poised for its marriage to mainstream computing

☐ *by Tom Manuel*

Unix, the computer operating system developed by AT&T Bell Laboratories, has become the most ubiquitous work of software since Fortran and Cobol. Almost every computer now made has Unix available for it. This fact alone should make it a de facto standard.

But in 15 years, Unix has not made it. Despite offering an environment that makes it easy to develop programs and holding out the promise of easily portable appplication software, Unix has yet to be accepted in the computing mainstream.

Now there are strong signs that Unix is moving to jump into the mainstream of commercial computing. But 1985 may be a year of crisis. Many vendors aiming to cash in on Unix's potential market face disaster if the operating system remains on the fringes.

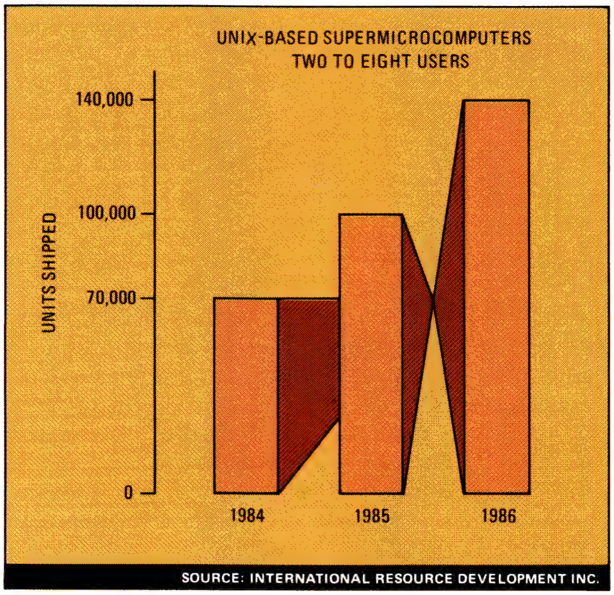
Two things have continued to bug the status of Unix as a standard. First, there are many variations of Unix that are not completely compatible. Second, there is as yet no large number of applications nor a horde of end users, compared with industry totals.

Unix is widely used in the scientific, academic, and engineering worlds of computing. However, these fields represent only a tiny fraction of the computer industry—some experts estimate it as low as 1%. At the ripe old age of 16, Unix has not yet grown up enough to catch on as a de facto standard in general office and business computer use—the commercial market. But a certain amount of maturity is becoming evident.

Last month, six major Western European computer manufacturers announced that they were getting together to develop application programs under Unix. The group did not go into details. All one representative would say is that "we are establishing a common application environment with a set of tools such as languages, work stations, and data-base management systems, and will define a standard software interface to our systems," so that programs written for one of the company's systems will run on systems from the other five. The six companies—Bull, Ing. C. Olivetti, Nixdorf Computer, Siemens, International Computers Limited, and Philips International—say they have not made a decision on which Unix to adopt. They claim to have been talking to AT&T, Microsoft, and some other major U.S. Unix vendors. AT&T should be in a good position because it owns 25% of Olivetti, and both companies have a London subsidiary to promote Unix in Europe.

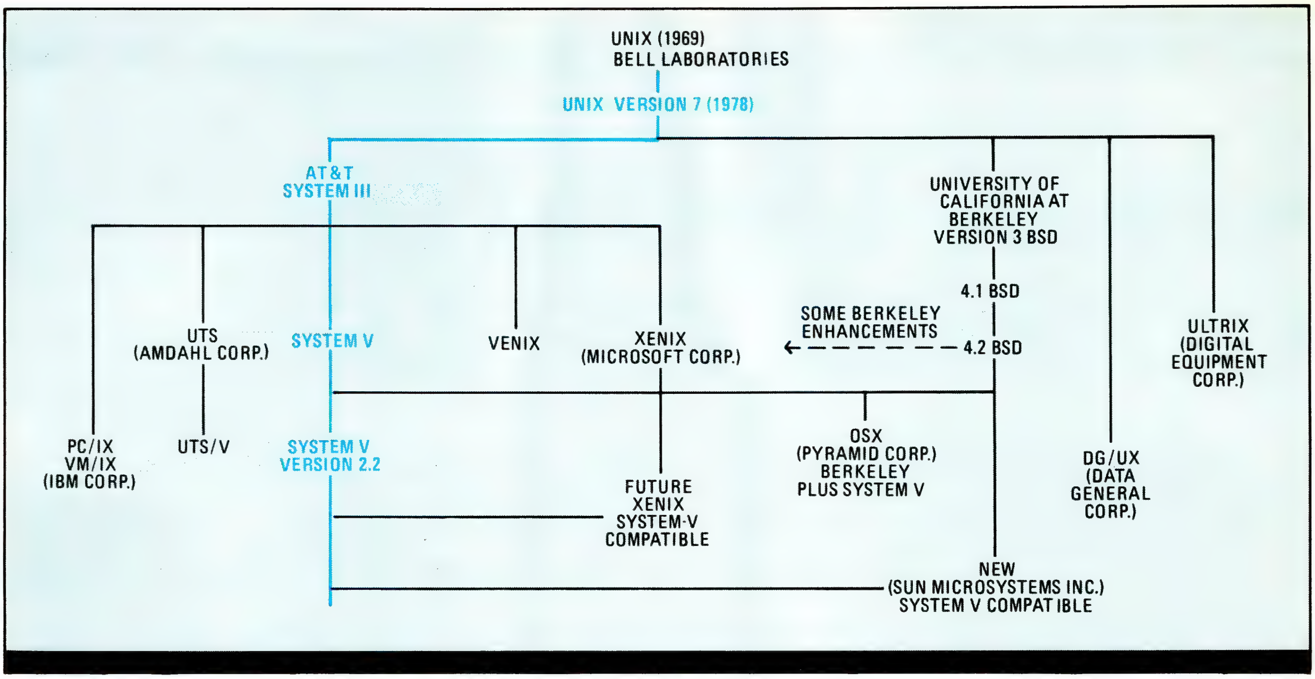
In the realm of operating systems—those programs that manage the resources in a computer—several de facto standards have emerged through widespread use. For example, for large and mid-size mainframe computers doing the bulk of data processing, the standard is the IBM Corp. System 360/370 architecture and its family of operating systems. For personal computers, another IBM operating system now dominates—PC DOS/MS-DOS for the IBM Personal Computer family and personal computers compatible with it.

In the area of superminicomputers, the VMS operating system for the Digital Equipment Corp. VAX-11 systems is almost a standard. What determines a de facto standard in these cases is that there are many appli-



SOURCE: INTERNATIONAL RESOURCE DEVELOPMENT INC.

1. Fastest growth. International Resources Development says two- to eight-user supermicrocomputers will grow the most among Unix machines. Unit shipments are growing nearly 50% a year.


UNIX (1969)
BELL LABORATORIES
UNIX VERSION 7 (1978)
AT&T
SYSTEM III
UNIVERSITY OF CALIFORNIA AT BERKELEY VERSION 3 BSD
4.1 BSD
SOME BERKELEY ENHANCEMENTS
4.2 BSD
ULTRIX (DIGITAL EQUIPMENT CORP.)
UTS (AMDAHL CORP.)
SYSTEM V
VENIX
XENIX (MICROSOFT CORP.)
PC/IX
VM/IX
(IBM CORP.)
UTS/V
SYSTEM V VERSION 2.2
OSX (PYRAMID CORP.) BERKELEY PLUS SYSTEM V
DG/UX (DATA GENERAL CORP.)
FUTURE XENIX SYSTEM-V COMPATIBLE
NEW (SUN MICROSYSTEMS INC.) SYSTEM V COMPATIBLE

2. Family tree. Unix, born at AT&T Bell Laboratories in 1969, has an extensive family tree, only part of which is shown here. The AT&T lineage currently stops at System V, version 2, release 2. Most other branches of the tree are evolving toward compatibility with System V.

cations programs available for those operating systems on the market as well as in-house.

Though there is a sizable market for Unix in the technical uses of computers, many of the Unix vendors are now striving to succeed in the commercial market, which is potentially much larger. In a presentation at the recent UniForum conference on Unix held in Dallas [*ElectronicsWeek*, Feb. 4, 1985, p. 19], Robert Lefkovitz of InfoCorp said that in 1984 Unix represented less than 1% of the worldwide information-processing market. By 1989, InfoCorp projects that Unix will still represent only a little over 1%. But that will still translate to a 39% compound annual growth rate and a Unix portion of the market valued at about $23 billion. Meanwhile, a recent report from International Resources Development states that the fastest growing Unix market is in two- to eight-user supermicrocomputers (Fig. 1).

Rich in features

Unix has many features and functions that make it attractive. For example, it is blessed with a simple file structure, hierarchical file directories, multitasking facilities, a rich software-development environment, and a large toolkit. Programs written for Unix systems are inherently portable among computers that run the system—much more portable than trying to move programs from one operating system to another.

Unix's many features make it suitable for distributed systems for applications such as text processing and computer-aided engineering. Unix is good for handling high-speed, high-bandwidth links between a processor and high-resolution screens. The many networked work-station systems that now exist need this capability, and it's no accident that most work-station systems run Unix.

The strengths and capabilities of Unix can also be applied to advanced personal computer network systems to provide features missing from current personal computers. For example, Unix is good for file sharing. Because Unix runs on every major computer, there is now the potential for providing a homogeneous file system shared among many computers. This widely available operating system can be a basis for distributed information processing in commercial applications.

The most important aspect of Unix for use in the office is its multitasking capability. Multitasking is particularly useful for distributed data processing. Unix's byte-stream file concept also suits the system for communications. Multitasking and good communication are what give a single-user work station the ability to handle simultaneous processes that do a variety of tasks, such as accessing remote files, printing on a centralized laser printer, and running user applications.

Proprietary operating systems are married to the vendor's hardware architecture. Unix is not married to any hardware and thus is much more portable—the reason it is on so many machines today. However, this portability is undercut by the proliferation of Unix versions. One of the big recent changes in the Unix world is the move toward unification of these various versions.

The Unix family tree has three major branches: AT&T Co.'s supported version, called System V; Microsoft Corp.'s Xenix, based on an earlier AT&T version, System III; and the 4.2 version developed by Bill Joy's team at the University of California at Berkeley (Fig. 2). Joy, well known in Unix circles as the mastermind behind the Berkeley versions, is now vice president of research and development at Sun Microsystems Inc.

Unix was born to be portable. The midwives were Ken Thompson and Dennis Ritchie of AT&T Bell Laboratories, working in 1969 on a DEC PDP 7 [*Electronics*, Oct. 20, 1982, p. 108]. Many versions—estimated to be somewhere between 27 and 30, according to various counts—with different added features have emerged over the years from diverse sources.

Until recently, two industry groups besides AT&T were creating a Unix standard. Both groups—the kernel standard committee of the Institute of Electrical and Electronics Engineers and the /usr/ Group—held meetings during the UniForum conference in January. The result was mutual agreement that one group should take care of everything, says Jim Isaak of Charles River Data Systems, chairman of the IEEE P1003 Committee.

The two groups merged under the banner of the IEEE committee. They hope to get the draft standard out to the IEEE membership for balloting sometime this summer. A few differences are evident between the current /usr/ Group document and AT&T's recently published "System V Interface Definition." Some of them may be ironed out by the committee before distribution of its proposed standard.

3. Belle of the ball. One of the most popular families of Unix systems based on the Berkeley 4.2 version of the operating system is the Sun Microsystems WorkStation series. A Sun-2/120 can be ordered with a high-resolution color monitor (right).

Though Unix is portable, almost a standard, and widely available, its adoption by the computing mainstream has been slow. The reason, industry observers say, is the dearth of commercial data-processing applications.

Immense requirements

The requirements for third-party software for Unix systems are immense. According to many executives well versed in Unix, commercial systems need strong error recovery and diagnostics along with lots of support. "Anyone who hopes to sell Unix to the commercial marketplace must build robustness into their system," says Beau Vrolyk, president of Areté Systems Corp. "We need to proceed from System V to a robust commercial system. The latest version 2, release 2 is an important step in that direction with the addition of virtual memory and the /usr/ Group standard record locking. System V is getting closer to a commercial-grade operating system but still has a long way to go."

Another plus that Unix has going for it is the love it garners from programmers. Yet vendors of personal-productivity software for personal computers have ignored the Unix world. The prime reason for this is that IBM set the operating-system standard for single-user personal computers with PC-DOS.

Aside from the IBM PC success, Unix should have by now gained a strong foothold in multiuser, multitasking, distributed-processing commercial systems where the IBM PC cannot compete, say many Unix proponents. But they also recognize what has held it back.

"Adoption of Unix as a mainstream system has been hindered for three main reasons," says Chuck Hickey of Microport Systems Inc. "When all three are realized, then Unix will become a mainstream operating system." The three main problems with Unix, according to Hickey, are the proliferation of incompatible versions; the lack of software applications, especially in portable, binary form; and the lack of a user-friendly interface.

Apple Computer Inc.'s Macintosh is creating user-interface expectations not yet matched by many Unix-based systems. Unix has to catch up. "Unix needs not only a highly flexible interface. The whole system needs to be made user friendly, as do the installation and maintenance," says Hickey.

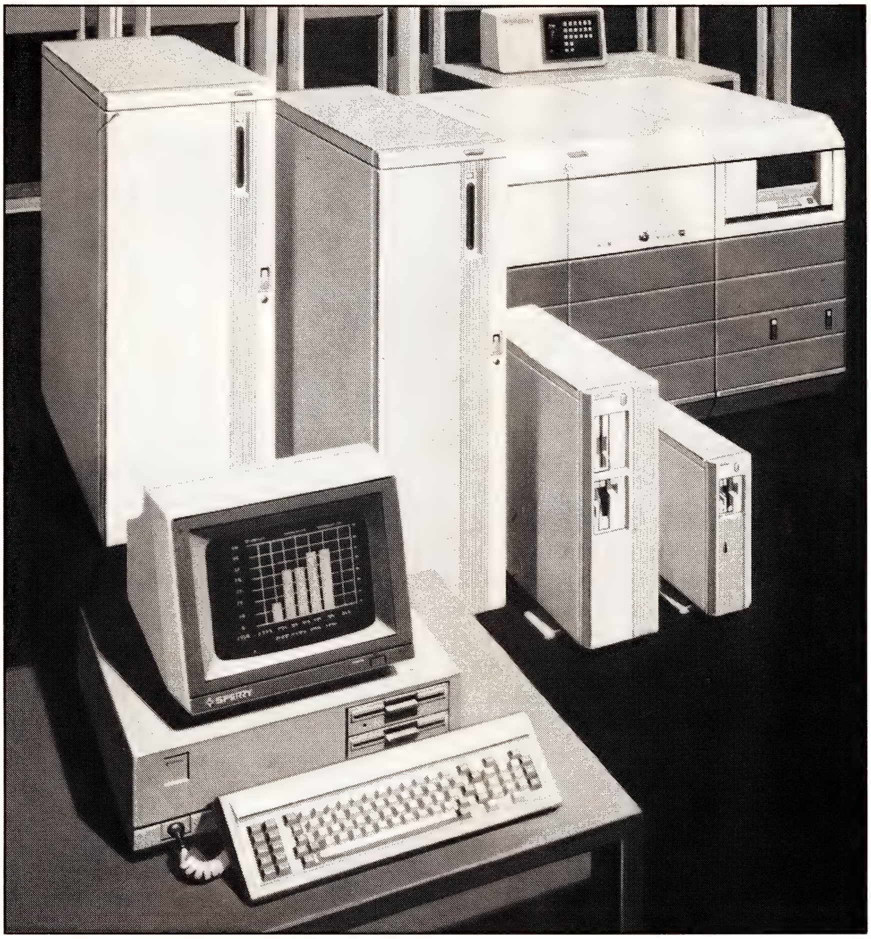
However, two of these three needs—standardization and applications—have begun to fall into place. Standardization is leaning toward the System V version supported by AT&T. Help will also come from the System V port for the Intel Corp. 80286, National Semiconductor's 32000 series, and Motorola Inc.'s 68000 microprocessors, as well as from Microsoft's decision to make Xenix compatible with System V.

Consolidation around System V is much more evident now, says Ken Cohen, of Oracle Corp., a vendor of software for data-base management. He thinks that IBM is less likely to be able to go its own way in Unix. But that remains to be seen, as the colossus of the computer industry seems to get its own way whenever it cares to.

AT&T's announcements and position statements also take some of the wind out of the Berkeley 4.2 version, says Cohen. The inclusion of virtual memory and record- and file-locking capabilities (which version 4.2 has) in the recent version 2, release 2 of Unix System V widens the applicability of System V and shows how much AT&T is listening to the market. "This is a major new release, and it comes not long after the last release. It shows that AT&T's commitment is not just a lot of talk," says Mike Sherman, Unix program manager at Elxsi.

System V is available for many processors today. The new ports for the three most popular 16- and 32-bit microprocessors should boost the popularity of System V. Because the Intel 286 has memory management on the chip, thanks to the 286 port binary copies—no recompiling necessary—of programs can be transported among systems based on the 286.

Unix System V also runs on the fastest computer systems available, such as the Amdahl Corp. 580, Elxsi 6400, Cray Research Inc. 2, Denelcor Inc. HEP, Convex Computer Corp. C1, and Areté Systems 1200. This makes it theoretically possible to build large networks of



4. Desktop to computer room. The Sperry Corp. 5000 series systems (center foreground) serve as very capable links between personal computers (front) and mainframes (rear). The 5000 series was designed and developed for Sperry by Areté Systems Corp.

mainframes, superminicomputers, and personal work stations with transparent file and resource sharing.

But version 4.2 of Unix is still very popular and maintains a significant stronghold in the scientific and engineering work-station arena (Fig. 3). The two versions appear to be merging. For example, Bill Joy, speaking at a plenary session at UniForum, announced that Sun Microsystems is designing the next version of its operating system, called NEW. It will be an enhancement of 4.2 but will also be compatible with System V—that is, it will run System V programs without change. NEW is still a paper system. Sun will circulate the specifications to interested parties by the next quarter.

Necessary capabilities

The motivation behind NEW is that some capabilities needed for new sophisticated applications on work-station systems are missing from both version 4.2 and System V. NEW will have all the 4.2 capabilities. In addition, it will have facilities for the efficient use of very large shared libraries; modern concurrency control, which will be the same across the operating system, application programs, processes, and monitors; a pageable operating-system kernel; and source-code compatibility with System V.

"System V and 4.2 split about 1976, and by 1986 we will get them back together with NEW," according to Joy. Sun intends to use favorable licensing terms to make NEW an open system.

The second hindrance to widespread Unix acceptance—the lack of applications—will be solved as vendors begin flooding the market with code-transportable commercial applications programs. Several industry observers expect this to happen this year. Some say it has already begun.

"Unix applications are starting to catch up to the mainstream," says Areté's Vrolyk, adding that it takes six months to a year to develop a serious application for a personal computer and two to three years to do a robust application for a big minicomputer. Many of his colleagues agree. "It has to take that long [or they won't be any good]," says Vrolyk. "It is unreasonable to have expected applications before now. However, they are beginning to pour in."

But the user-interface obstacle has yet to be removed. Unix still needs a good user interface before it will be generally accepted in the office.

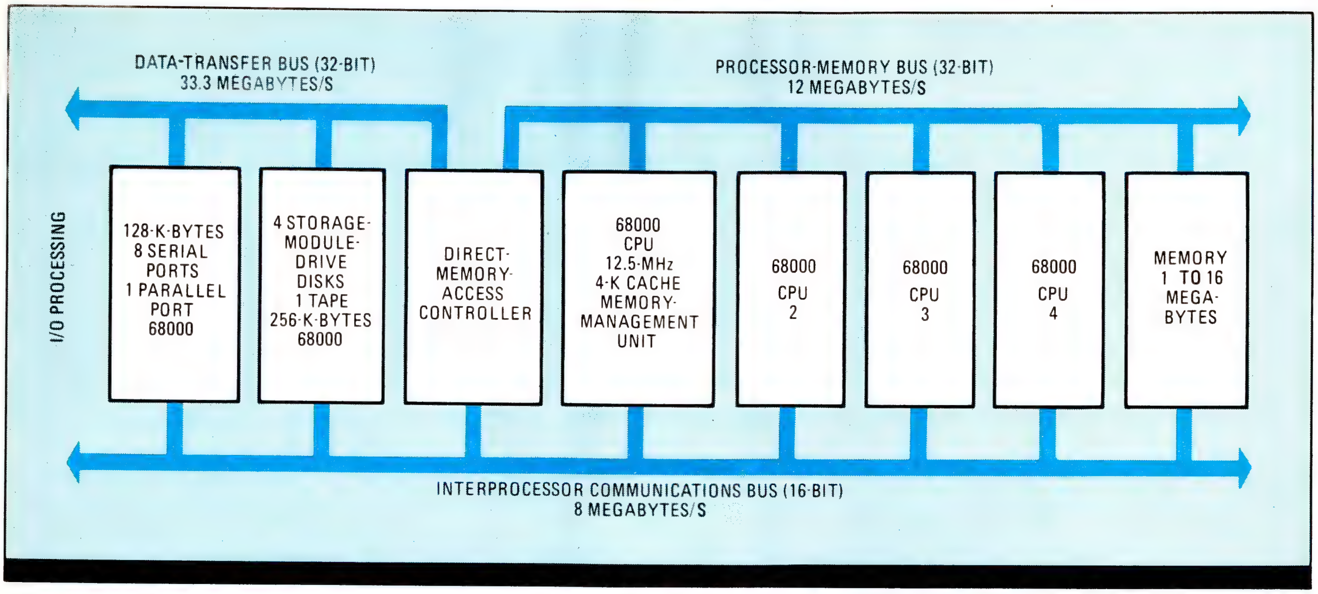
"Well, though we have yet to see a truly friendly System V user interface, an interface like the one on the Apple Macintosh, Hewlett-Packard's Integral computer [a Unix machine] has an interface that comes close," says Hickey. "What will make the market go is a portable graphics-oriented user interface like the Macintosh. If Digital Research's GEM, which is very much like the Mac interface, were available on Unix, it could be very significant."

Aaron Goldberg of International Data Corp. agrees. "If everyone jumped on a GEM or Topview [a windowing interface from IBM] as a standard interface for Unix, it would be great."

A lot of inertia exists in the commercial world because of the IBM entrenchment, and that goes against Unix. If any operating system can turn the stampeding herd away from IBM operating systems, it is Unix, with its own growing mass of supporters. IBM's lack of commitment to Unix or any efforts directed against it will only build up the IBM operating systems inertia. Its full support of a Unix standard would instantly reverse the situation.

But that is highly unlikely. IBM is confusing the market on purpose, say many in the industry. And it has a powerful impetus: Unix disturbs the cozy IBM world.

Much speculation centers on which software operating environment IBM will choose to integrate its various systems. IBM customers are loudly protesting the fact that IBM mainframe operating systems, such as MVS and VM, do not play in the same sandbox as IBM's systems 3, 34, 36, and 38. Nor do they get along with the Series 1 minicomputer and the various IBM PC operating systems—PC-DOS, Topview, and Xenix.



5. Two in one. The Areté system has two optimized parts. The application multiprocessor is tuned to run Unix applications efficiently. The other part provides fast input/output performance and is controlled by a real-time executive to handle I/O as quickly as possible.

Interoperability among the various IBM systems is a confusing mess that customers want solved. IBM has not announced a complete solution. Nevertheless, it is not likely to be Unix. A Unix-like environment with some Unix compatibility is possible. Most probable will be a completely proprietary IBM system that is totally incompatible with Unix.

Some industry observers indicate that IBM may groom either the System 36 or the Series 1 as a cluster controller to provide a departmental hub for distributed information processing involving IBM PCs, mainframes, and minicomputers. But for now, IBM seems content to just leave the whole picture as confusing as ever.

A place in the sun

Because Unix provides a convenient way for people to communicate when using computers, it will likely find a place, despite IBM, in systems that become communication gateway servers and information/file servers—a bridge between personal computers and mainframes. Unix systems can become hubs for satellite processors in both factory and office automation. The Sperry Corp. 5000 Series (Fig. 4) is a good example of a system that can play this role.

The use of Unix systems as departmental information systems is a niche waiting to be filled, says Glenn Patterson, Areté's marketing vice president. The Unix systems in this role will be an information center for thousands of personal computers running standard PC-DOS with common IBM PC applications. These servers will not only supply file and printer services but also communications and information services from connections to mainframes, corporate data bases, and public information services. This approach will give information-management or data-processing managers some control because it will not require a lot of individual input/output ports on their mainframes.

The IBM PC AT, with its 286 processor, the availability this month of Xenix from IBM, and a PC AT version of the 286 port of System V from Microport are in the wings. This makes it tempting to speculate about the PC AT as a Unix engine. "The potential application performance of the AT is clearly underserved by a single-task, single-user operating system [such as MS-DOS or PC-DOS]," says John Butler, vice president of Applix Inc. Applix supplies Alis, an office automation application system. This could lead to Unix as a favored choice for PC AT applications. It is also possible that IBM could put some proprietary multitasking operating system on the PC AT—perhaps an enhanced Topview with good graphics. The delivery of multitasking MS-DOS and MS Windows has been continually put off—MS Windows is now promised for June 1985.

But Jean Yates, of Yates Ventures, a market research firm specializing in Unix, does not think that Unix will be important for the PC AT. "In the personal computer world, Unix is not an entity. MS-DOS is it. There will be no real change here. The PC AT with Xenix is an adjunct only," she says. But the older IBM PC may get to play in the Unix world once add-ons such as the 32-bit processor boards from Opus Systems Inc. and Sritek Inc. turn it into a Unix work station [*ElectronicsWeek*, Jan. 14, 1985, p. 24].

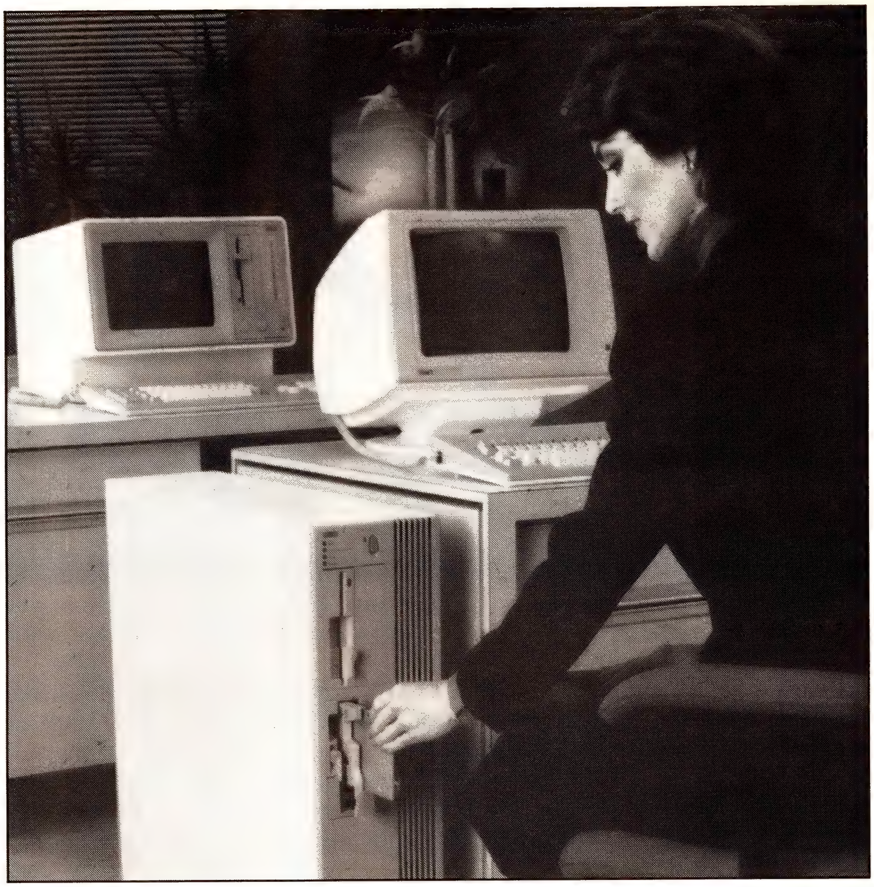
Applications and more applications

Unix will probably become the standard for work-station systems. As prices fall, these systems will become a commodity market. Differentiation will come from packaged applications (see related story, p. 59). The more innovative the application, the faster its vendor can stake out a piece of the market. Unix will live or die on what and how many applications get developed for it.

The technical reasons for choosing Unix over MS-DOS will not tell the whole story. "Really good applications that require Unix will tip the balance," Bill Joy says. "Take some of the office software you see on a Wang or IBM PC. We [at Sun Microsystems] can show you a document-preparation system that runs on a Unix-based Sun and an information-management system that runs on a network of Suns. They are so much better [than what is available for personal computers today] that you have to think of them as a different generation. It's almost indescribable. It interacts with the user in real time. It's state of the art in document preparation, and it's basically 5 to 10 years of research ahead of the people who did the word processors."

Most microprocessor Unix systems have two weaknesses, according to Vrolyk. In the first place, the rest of the computer around the central processing unit needed to support applications—for example, an adequate I/O subsystem and memory subsystem—was often left out. Second, most vendors until now have approached the technical and engineering segments of the market rather than the general-user sector.

There have been three generations of Unix microsystems already. In the first, vendors simply threw together a microprocessor, some memory, and a little I/O, and put a Unix on it. The second generation contains some serious systems designed to optimize the running of Unix. (Plexus Computers is the best example of these computers tuned to Unix.) The third generation, according to Vrolyk, are Unix systems tuned for commercial applications. The Areté system is one of these because it is built for fast, high-volume I/O.



6. Tower in the office. The NCR Corp. Unix-based Tower business systems are designed for offices. This enhanced performance Tower XP brings yet another Unix commercial product line into the System V fold. The XP has a serial I/O controller using the 68010 processor.

Areté was founded to build a Unix-based system for commercial applications. The architecture includes a fast bus and a fast I/O system plus a commercial-strength fast Cobol compiler. The system's fundamental concept is to have two halves—each tuned to its application and each able to handle multiple processors (Fig. 5).

The first half runs Unix applications; the second has a real-time executive to run the I/O subsystems, such as disk drives with the multiple file systems that commercial applications require, magnetic tape drives, printers, and communications. For example, it emulates the IBM Systems Network Architecture and all the protocol conversion required without degradation of the machine's Unix portion.

Areté claims that its system is the first commercially oriented Unix box in the industry. It has no floating-point hardware because Cobol does not use floating-point processing. Areté is going after that 80% of the commercial market that uses Cobol code. Its competition is IBM, Burroughs, NCR (Fig. 6), and other computer giants—not Pyramid or Ridge, for example, says Vrolyk.

Faster and faster

Applications need faster execution speeds. One way to get them is to use a compiler that creates efficient code that runs as fast as possible. Good compilers are needed for Unix systems.

"There is now a great push to get Unix into the commercial market mainstream," says Bob Gildenberg, vice president of marketing of Philon Inc. "It won't occur unless software is there to support it. One lack until now hindering the development of robust commercial applications was good high-level-language compilers—efficient compilers."

Most compilers for Unix systems came up from the 8-bit-microcomputer level. But the serious applications developers are coming down from mainframes. They can't put their existing mainframe applications on 68000-based Unix systems without mainframe-caliber compilers that have high levels of performance, efficiency, functionality, and support.

The MC68000 is not the only environment in which Unix is going to play a major role, according to Gildenberg. The Intel 80286, National 32000, and the IBM PC AT need the same fast compilers so that applications vendors can easily implement their products on all 68000, 80286, and 32000 machines. It helps to have the same compilers on all machines in a network.

Commercial-grade compilers are emerging from several vendors. Two examples are the very efficient, fast compilers from Philon and the mix-and-match polyglot compilers from Language Processors Inc. With Language Processors' polyglot capability, a programmer can mix portions of programs written in different languages into the same program. Both companies offer C, Cobol 74, Basic, Pascal, PL/I, and RPG II compilers. Philon will soon also have Fortran. ☐

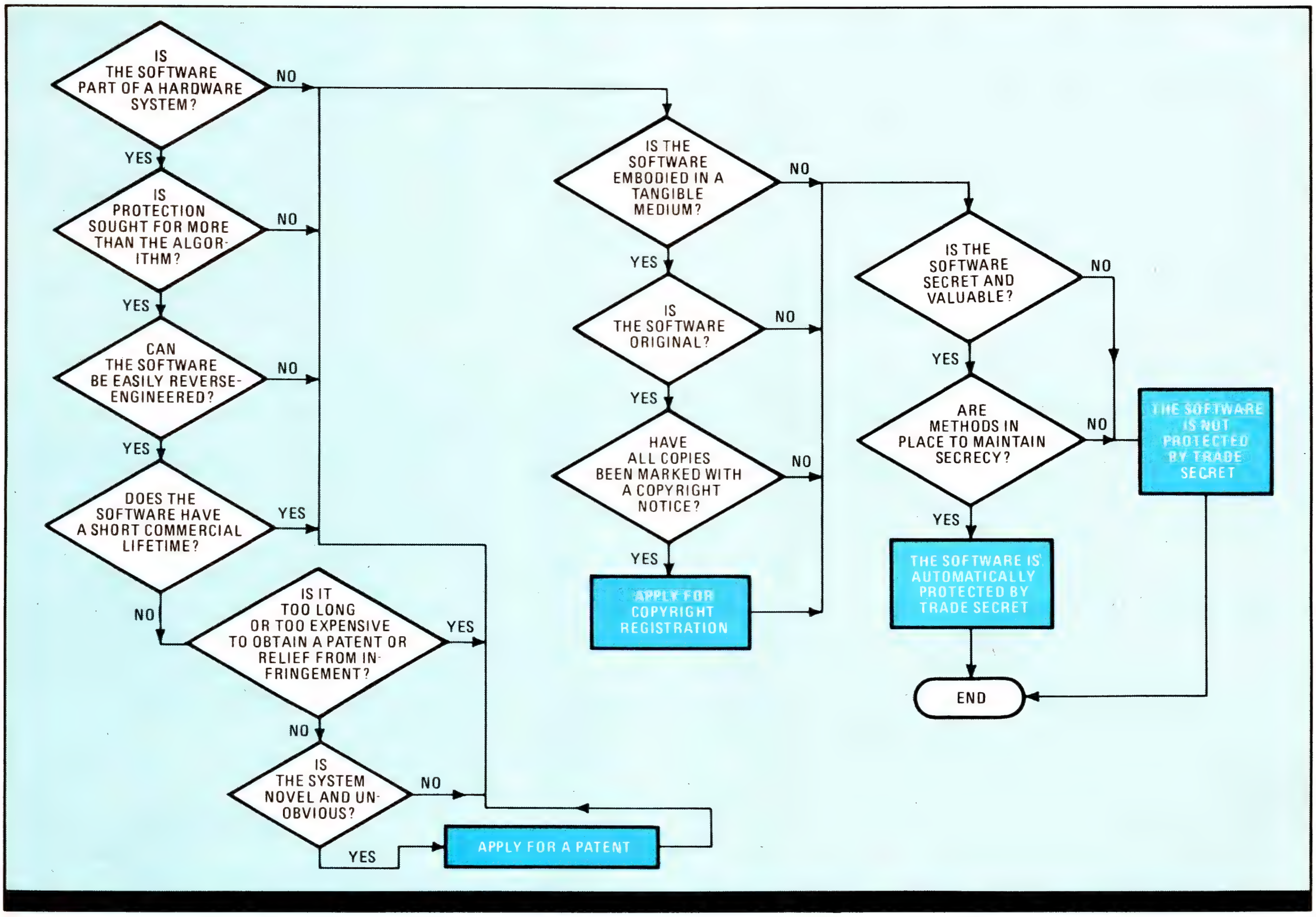
LEGAL DEFENSES AGAINST PIRACY

Software protection in the U.S. is a forest of facts, fantasies, methods, and results

☐ *by Peter L. Michaelson and Michael B. Einschlag*

Incidents of software theft and piracy have reached epidemic proportions in the U.S., resulting in significant lost revenues. For every legitimate copy of a commercially successful program currently on the market, there exist at least four—some estimates are as high as 10 or more—pirated copies. Furthermore, as the success of a program increases, so does the number of pirated copies. Surprisingly, both large and small organizations copy illegally, sometimes secretly and sometimes openly.

Under current law, software can be protected against unauthorized and illegal use in the U.S. in one of three ways: by obtaining a patent, by claiming copyright, or by treating the software as a trade secret (see "Comparison of patents, copyrights, and trade secrets," p. 54). Each of these three avenues affords certain specific forms of protection; each also has its particular limitations. The ex-


IS THE SOFTWARE PART OF A HARDWARE SYSTEM?
NO
YES
IS PROTECTION SOUGHT FOR MORE THAN THE ALGORITHM?
NO
YES
CAN THE SOFTWARE BE EASILY REVERSE-ENGINEERED?
NO
YES
DOES THE SOFTWARE HAVE A SHORT COMMERCIAL LIFETIME?
YES
NO
IS IT TOO LONG OR TOO EXPENSIVE TO OBTAIN A PATENT OR RELIEF FROM INFRINGEMENT?
YES
NO
IS THE SYSTEM NOVEL AND UNOBVIOUS?
NO
YES
APPLY FOR A PATENT
IS THE SOFTWARE EMBODIED IN A TANGIBLE MEDIUM?
NO
YES
IS THE SOFTWARE ORIGINAL?
NO
YES
HAVE ALL COPIES BEEN MARKED WITH A COPYRIGHT NOTICE?
NO
YES
APPLY FOR COPYRIGHT REGISTRATION
IS THE SOFTWARE SECRET AND VALUABLE?
NO
YES
ARE METHODS IN PLACE TO MAINTAIN SECRECY?
NO
YES
THE SOFTWARE IS AUTOMATICALLY PROTECTED BY TRADE SECRET
THE SOFTWARE IS NOT PROTECTED BY TRADE SECRET
END

1. Protection selection. The type of protection applicable to a given piece of software is determined by a variety of factors. By following the steps in the flowchart, it is possible to determine which of the three types of protection available will serve the user best.

tent and limitations of each type of protection, the methods generally adopted by U.S. industry to protect software, and recent judicial and legislative developments aimed at strengthening the protection for hardware and software are all factors to be considered when deciding which route to take to provide protection (Fig. 1).

Patent protection

By itself, software is not patentable. In combination with hardware, it is. Whether patent protection is worthwhile depends on the situation. But often, it is not.

Patents provide very strong protection for intellectual property. As provided by federal statute, anyone who invents or discovers any new and useful process, machine, manufactured article, or composition of matter or any new and useful improvement thereof may file for and obtain a patent.

The essence of software, however, does not lie in a process, machine, manufactured article, or composition of matter but rather in its underlying algorithm—a sequence of steps which, when followed, perform a useful and intended result. Although an algorithm is meant to be implemented on high-speed processors, humans, in theory and given enough time, can also perform the algorithm to yield the same result.

With this in mind, U.S. courts have held an algorithm to be nothing more than a sequence of mental steps that does not fall within the statutory classes of patentable subject matter. Hence, these courts have concluded that software, by itself and devoid of any relationship to the hardware that it controls, is nonpatentable.

Recently, the U.S. Supreme Court ruled that the use of a software-based algorithm in a digital computer to control a process for curing rubber did not render the process nonpatentable. Consequently, patent protection can be obtained for a structure or process that utilizes a software-based algorithm as one of its elements to achieve a utilitarian function.

U.S. patent protection begins on the date a patent issues from the U.S. Patent Office. However, that date often occurs at least two years after the underlying patent application has been filed in the patent office. Because most software generally has a short product life, most of the useful product life of the software has ended before patent protection on the software and its attendant hardware has begun. Nonetheless, where product life is longer and patent protection is secured, a patent owner obtains strong exclusive rights, which he can exercise during the 17-year term of a patent. In addition, a patent owner can license his patent to others. Through licensing, the patent owner receives something of value, typically royalties, from his licensee.

Even if meaningful patent protection is obtained, enforcement against infringers is difficult. Full-scale patent litigation is complex and often stretches over many years.

Therefore, several factors militate against using U.S. patent protection for software in most situations: the uncertainty surrounding the patentability of software, the short product life of most software, and the protracted period of time required to obtain both patent protection and effective relief from infringement.

Copyrighting software

Software can be copyrighted, however, and copyright protection is definitely worthwhile. Copyrights, in contrast to patents, provide immediate protection. This protection begins as soon as an original work of authorship (such as a program) is fixed in a tangible medium (such as being printed on paper or stored in a read-only memory chip, in floppy disks, or on magnetic tape) and lasts for at least 50 years.

By federal statute, a copyright provides the copyright owner with the right, subject to certain exceptions, to control unauthorized copying of his copyrighted work. Copyright protection is limited to the form in which the work of authorship is conveyed, however, regardless of whether that form can be read by humans or machines. Furthermore, copyrights, like patents, can also be licensed.

A number of years ago, various U.S. courts began to consider whether software could be copyrighted. A major issue addressed by these courts was whether software was

Comparison of patents, copyrights, and trade secrets

Although patents, copyrights, and trade secrets all provide protection for the owner, they apply to specific areas.

- A utility patent applies to a process, machine, article of manufacture, composition, or any improvement of these that is both novel and nonobvious.
- A copyright is for original works of authorship fixed in any tangible medium of expression, now known or later developed, from which these works can be perceived, reproduced, or otherwise communicated either directly or with the aid of a machine. There is no protection for an idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied.
- A trade secret constitutes information that is not widely known and conveys a competitive advantage to the party or parties who possess it.

Each one of these means of protection is effective for a different period of time.

- *Utility patent.* Protection begins only when a patent is issued. This now takes more than two years from the time a patent application is filed. However, "Patent pending" or the like can be affixed to the article or used in advertising in connection with the article as soon as the patent application is filed. The patent application is carefully examined. Patent protection ends 17 years after the patent issues.
- *Copyright.* Protection begins as soon as the work is fixed in a tangible medium of expression; that is, registration is not a prerequisite to obtaining copyright protection. A copyright application is only cursorily examined, and protection lasts for at least 50 years.
- *Trade secret.* Protection begins as soon as the trade secret is created. This protection lasts indefinitely, provid-

purely functional. Early on, U.S. courts have held that items that are purely utilitarian—that is, designed to perform a given function rather than being artistic or expressive in nature—were not copyrightable, and that if protection is to be had for these items, that protection must come from a U.S. patent.

At first, various U.S. courts perceived software as merely an element that controlled the operation of a computer to produce a desired result. Therefore, the courts held software to be purely functional and hence noncopyrightable. Over the past few years, a number of influential U.S. courts, in well-reasoned opinions, have realized that because software both contains significant amounts of original authorship that is independent of the function performed by the software (a program can be written in many different ways to perform the same function) and is fixed in a tangible medium, it qualifies as copyrightable subject matter, even when stored in ROM.

Furthermore, the Copyright Act was amended in 1980 to permit limited copying of a computer program (for archiving, for example). In effect, the act now recognizes that software is copyrightable. Hence, current U.S. law is such that software, including both source code and object code, fixed (stored) in ROM or other tangible media, is now universally recognized by all concerned as being eligible for copyright protection.

The rights provided by U.S. copyrights are far narrower than those provided by patents. Copyright law provides no relief against one who distills the underlying algorithm from a copyrighted program and, using the algorithm, writes a non-infringing program. However, this restriction is not as limiting as it first appears, inasmuch as most software misappropriation in practice involves the type of slavish copying that is actionable under the copyright statute. Such slavish copying is generally the rule where short-lived consumer goods (particularly video games and software for home or personal computers) are involved and a competitor is seeking to minimize his product-development time.

Copyright-infringement actions are generally far simpler than patent-infringement actions and often provide a fast and effective remedy against copying. To sue for copyright infringement under the present U.S. Copyright Act and to take advantage of all the remedies provided by that act, a copyright registration must first be made. This entails depositing a complete copy of the software (or a specified portion thereof) in the U.S. Copyright Office (which forms part of the Library of Congress).

Currently, all copyright deposits (with some minor exceptions, such as secure tests) are publicly accessible. Although the Copyright Office is considering proposed rules to eliminate public access to software deposits, these rules have not yet been adopted. Therefore, anyone who now deposits software in the Copyright Office runs a risk, albeit a minimal one, that a third party will examine the deposited software, discern its underlying algorithm, and produce a noninfringing version.

As noted, copyright protection begins when software is fixed in a tangible medium and notice of the copyright is communicated to others by an appropriate copyright notice. Consequently, a proper copyright notice should be applied to all software as soon as possible during its development to notify others of its copyrighted nature. Notwithstanding the limited nature of copyright protection, copyrights have proven to be an effective practical weapon against software misappropriation.

Trade secrets

Software can also be protected as a trade secret. However, this type of protection also depends on certain conditions in order to be worthwhile.

Trade secrets cover a broader range of subject matter than do patents and copyrights. In general, any item of intellectual property can be the subject of a trade secret, as long as that item is not generally known by others, conveys a competitive advantage to one who possesses it, and is kept secret. For example, business information (such as customer lists and financial information), designs, and software can all qualify as trade secrets.

Unlike patent and copyright protection, which are provided by federal statute, trade-secret protection emanates from state law and hence varies from state to state. This

ed the information remains secret and adequate steps are taken to protect its secrecy.

The rights and remedies available to the owner vary with each type of protection.

- *Utility patent.* During the term of any patent, its owner has the right to exclude others from making, using, or selling the claimed invention anywhere in the U.S. The owner can sue infringers and obtain remedies such as actual damages, injunctions against infringement, prejudgment interest, and court costs. If the infringement is found to be willful, treble damages and attorneys' fees can be awarded. Furthermore, in certain instances, exclusion orders can be obtained to bar imports that infringe upon the patent from entering the U.S.
- *Copyright.* The owner of a copyright has the right to control copying and distribution of copies of the copyrighted work, to control preparation of derivative works based upon the copyrighted work, and, for certain works, to control public display and performance of the copyrighted work. The owner can sue infringers and obtain such remedies as actual damages, infringer's profits attributable to infringement, injunctions against infringement, statutory damages, prejudgment interest, court costs, and seizure and forfeiture of infringing articles. If the infringement is found to be willful, attorneys' fees can be awarded. Furthermore, in certain instances, exclusion orders can be obtained to bar infringing imports from entry into the U.S., and criminal penalties are available in some cases.
- *Trade secret.* The owner of a trade secret can sue infringers and obtain such remedies as actual damages, injunctions against use, disclosure to others of the trade secret, and court costs.

Congressional action

Congress recently recognized that the protection accorded by U.S. intellectual-property laws, particularly patents and copyrights, is insufficient and thus often ineffective to counter the substantial ongoing misappropriation of computer technology. As a result, Congress is now taking active steps to remedy these defects.

First, regarding computer hardware, Congress recognized that designs embodied in the three-dimensional layered structure of an integrated circuit were generally unprotected under current law. This, in turn, allowed many incidents of chip piracy to occur unchecked. To counter this piracy, Congress outlawed unauthorized duplication and distribution of chips by passing the Semiconductor Chip Protection Act of 1984. This act establishes a new form of intellectual property for mask works, which are defined as a series of related images that represent 3-d patterns in the layers composing a semiconductor chip.

If certain prerequisites are met, the owner of protected mask works is granted for 10 years the exclusive rights to reproduce the mask works by any means, to import or distribute a semiconductor chip product embodying the mask works, or knowingly to cause or induce another to do any of these acts. Furthermore, initial protection under the act is obtained either through registration of the mask work or through proper commercial exploitation of a semiconductor chip product embodying these mask works. Nonetheless, the act grants a limited right to third parties to reverse-engineer any semiconductor product containing protected mask works in order to extract the underlying teachings of the protected mask works, and embody these teachings in noninfringing mask works.

Second, Congress recognized and is now attempting to eliminate another form of software piracy. This piracy involves third parties who rent the software from purchasers and then make illegal copies. Through this practice, those who develop and sell software are losing significant numbers of sales. To counter this piracy, Sen. Charles Mathias (R., Md.) recently introduced a measure (S. 3074), which, if enacted, would outlaw this rental practice.

U.S. law now provides significant protection for software and computer technology, including both computer hardware and software. As the U.S. depends increasingly on software and computer technology, however, new forms of piracy will inevitably evolve.

protection arises out of a confidential relationship between the owner of the trade secret and another party. Trade secrets can last indefinitely—that is, as long as the subject matter of the trade secret remains secret and adequate steps are taken to ensure its continued secrecy.

Although U.S. patent or copyright protection protects its owner against any third-party infringers, trade-secret protection does not. Anyone who successfully discovers a trade secret through legal means, such as reverse engineering, can use the trade secret without any interference from its owner. Because trade-secret protection is based on a confidential relationship, anyone who obtains trade-secret information as a result of a breach of such a confidential relationship and who has actual or constructive knowledge of the existence of that relationship can be restrained from using the trade secret.

Like patents and copyrights, trade secrets can be licensed by what are often referred to as know-how licenses. When such licenses cover trade secrets embodied in software, they should include various restraints.

The vast majority of software in the U.S. is protected through trade secrets. However, since trade secrets provide no protection against third-party reverse-engineering, trade-secret protection is wholly inadequate to protect software destined for commercial public distribution. Hence, trade-secret protection by itself should only be relied on in those instances where access to the software can be tightly controlled.

Because the public should rarely, and preferably never, be given access to the source code, the current practice is not to register the source code unless and until the Copyright Office permits secret deposits or unless actual copyright litigation involving the source code is contemplated. Nonetheless, both the object-code and source-code versions of any software should bear prominent copyright notices, preferably in the comment sections at the beginning, middle, and end of the software.

Because trade-secret protection cannot protect against reverse-engineering, a number of technical methods have been devised to thwart reverse-engineering and detect unauthorized copying.

Recent developments

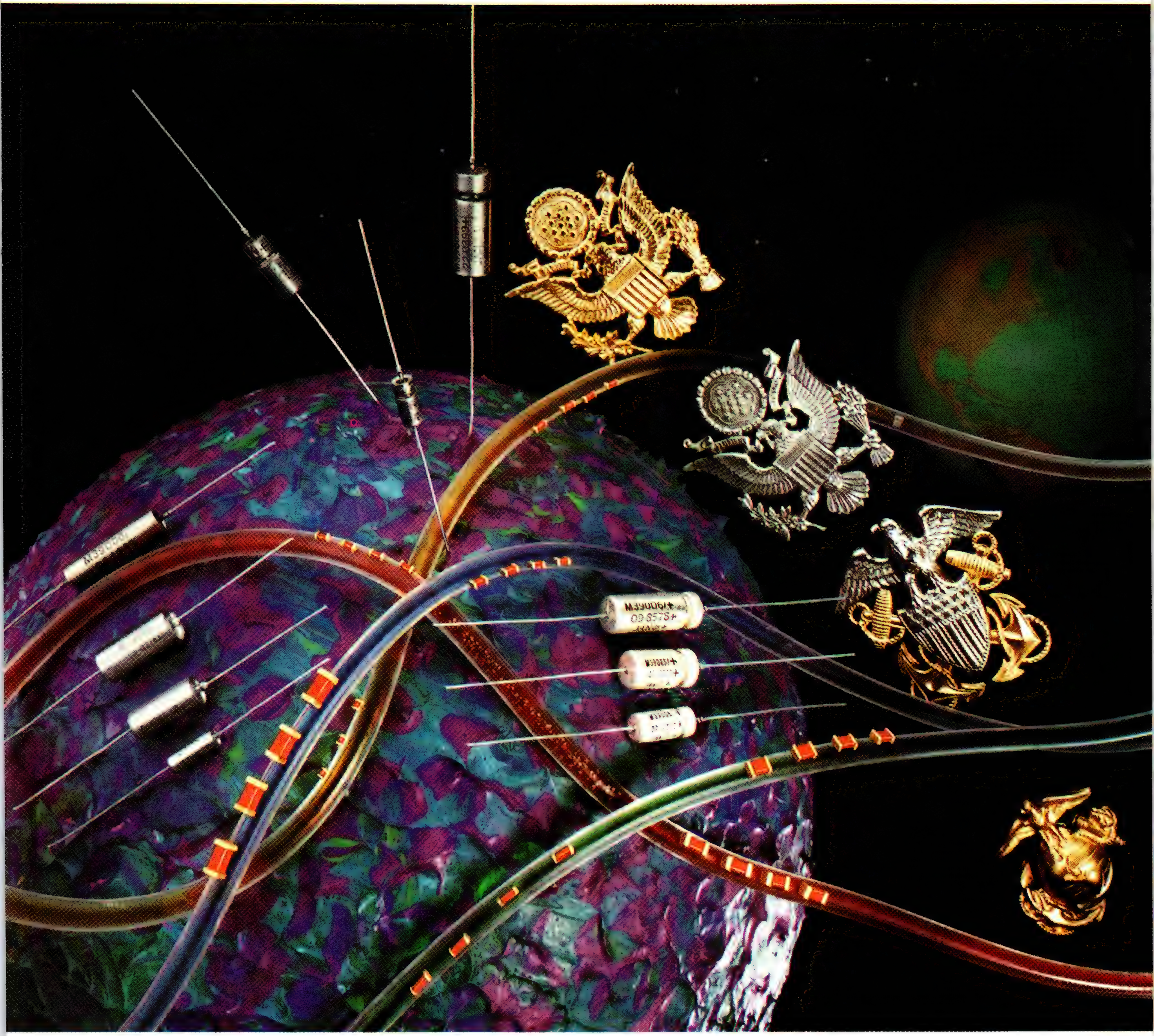
Over the past few years, U.S. computer manufacturers have become increasingly litigious and have taken advantage of U.S. intellectual-property laws to counter, at least temporarily, the increasing onslaught of misappropriation. Congress has also looked at this situation with a view to increasing the protection available to software owners (see "Congressional action," above).

Apple Computer Inc. obtained an exclusion order from the U.S. International Trade Commission that barred the importation into the U.S. of personal computers and various subassemblies used therein, which were manufactured primarily by establishments based in Hong Kong and Taiwan and which infringed on various U.S. patents and copyrights that Apple held on its personal computer hardware and software, respectively.

In other recent cases involving Apple and Midway Manufacturing Co. (makers of the Pac-Man video game), U.S. courts have upheld that programs are copyrightable, particularly those stored as object code in ROM, and have generally granted relief against unauthorized duplication of the ROM code. ☐

Peter L. Michaelson and Michael B. Einschlag are attorneys, with degrees in electrical engineering and physics, respectively, and are partners in the firm of Michaelson, Einschlag & Ostroff, Red Bank, N.J., which practices intellectual-property law.

READINESS.



4SW-4134

SPRAGUE TANTALUM CAPACITORS— FIT FOR DUTY.

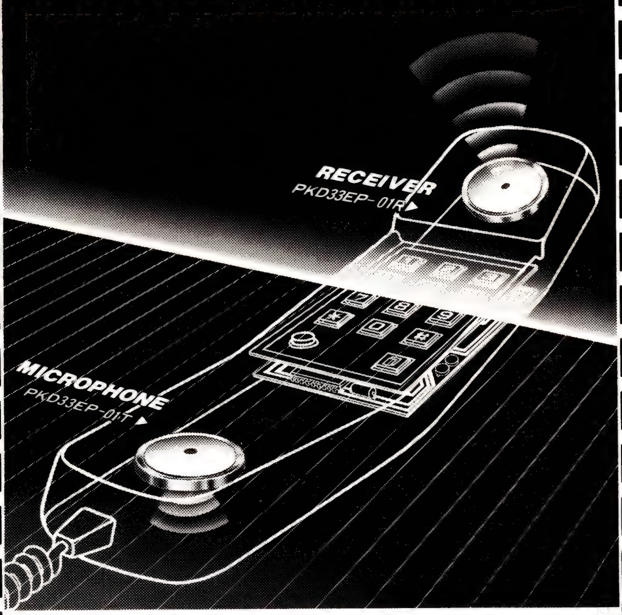
Sprague manufactures the widest range of tantalum capacitors qualified for the toughest military and high reliability applications. Solid tantalums, chips, wet & foil tantalums are all available from a worldwide source. Put Sprague technology, which developed "S" level, Option H 'Random Vibration and High Shock Capability' wet & foil tantalums to work for you.

For additional information on product assistance, delivery, or price, contact your Sprague Electric district office or sales representative or write to Sprague Electric Company, a Penn Central unit, 35 Marshall Street, North Adams, Mass. 01247.

Circle 57 on reader service card

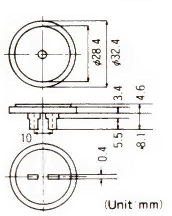
SPRAGUE
THE MARK OF RELIABILITY

MURATA'S CERAMIC ELECTRONIC TECHNOLOGY PROVIDES MILDEST AND PLEASANT TONE

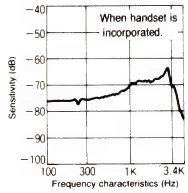


● Uses ultra-thin piezo ceramic element. ● Low freq. 0.3-3.4 KHz. ● Directly driven by ICs at high impedance. ● Least degradation during services ● Compact-size and lightweight.

● **External dimensions**



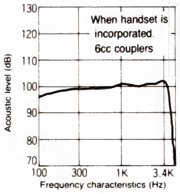
● **Sensitivity & Freq. characteristics (Microphone)**



⟨Specifications⟩

- ●Sensitivity: -73dB (0dB = 1V/0.1Pa)
- ●Capacitance: 55nF (at 120Hz)
- ●Frequency range: 0.3~3.4KHz

●**Acoustic level & Freq. characteristics (Receiver)**



- ●Acoustic level: 105dB (1Vrms 1KHz 6cc coupler)
- ●Capacitance: 55nF (at 120Hz)
- ●Frequency range: 0.3~3.4KHz
- ●Input voltage: 30Vp-p max.

For Telephone

PIEZO MICROPHONE /RECEIVER

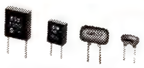
Murata provides the newly developed piezo microphone/receiver, piezo ringers, and the ceramic resonator (CERALOCK®) in kits for effectively meeting all the needs for electronic communications.

PIEZO RINGER

PKM44EW-1001

The Piezo Ringer generates mild and pleasant tone using 800 ~ 1,300Hz of low frequencies. Murata provides its Piezo Ringer and (CERALOCK®) together with useful circuit design techniques.

CERALOCK®



CBS series CSA series

Murata provides series of (CERALOCK®) ceramic resonator designed for use with microcomputers.

For further information, contact:

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. ········ Phone:404-953-1799 Telex:542329
3002 Kingston Court, S.E., Marietta, GA 30067, U.S.A.
MURATA ERIE ELEKTRONIK GMBH (West Germany) ········ Phone:0911-66870 Telex:623763
Kreuzsteinstr, 1A D-8500 Nürnberg 52, West Germany
MURATA ERIE ELECTRONIQUE S.A. (France) ········ Phone:024-6767 Telex:699954
MURATA ERIE ELETTRONICA S.R.L. (Italy) ········ Phone:688-4833 Telex:330385
MURATA ERIE ELECTRONICS (UK) LTD. (England) ········ Phone:2514-28585 Telex:858971

muRata
MURATA MFG.CO.,LTD.

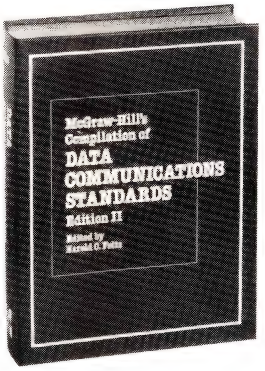
HEADQUARTERS
26-10, Tenjin2-chome, Nagaokakyo, Kyoto 617 Japan ········ Phone:075-921-9111 Telex:64270 MURATA J
MURATA ELECTRONICS SINGAPORE (PTE.) LTD. (Singapore) ········ Phone:2554233 Telex:21127
TAIWAN MURATA ELECTRONICS CO., LTD. (Taiwan) ········ Phone:042-91-4151 Telex:11348
(Taipei Office) ········ Phone:02-562-4218
MURATA COMPANY, LTD. (Hong Kong) ········ Phone:0-262099 Telex:56208
MURATA MFG. CO., LTD. Seoul Branch (Korea) ········ Phone:720-7605/720-7321 Telex:25858

Circle 94 on reader service card

NEW EDITION

Complete and Unabridged American and International

DATA COMMUNICATIONS STANDARDS


McGraw-Hill's Compilation of
DATA COMMUNICATIONS STANDARDS
Edition II
Edited by Harold C. Folts

All standards are new, revised, or reaffirmed since the previous edition

1,923 pages
illustrated
Edited by Harold C. Folts

Presents all 123 interface protocol standards set by:
● International Telegraph and Telephone Consultative Committee (CCITT) ● International Organization for Standardization (ISO) ● European Computer Manufacturers Association (ECMA) ● American National Standards Institute (ANSI) ● Electronic Industries Association (EIA) ● U.S. Government (NBS and NCS)

Special feature for instant access:
Cross-reference tables of the standards of each group corresponding to those published by the others.

An essential reference for all who are exploring, planning, developing, manufacturing, or using data communications equipment or networks.

Return Coupon to:
Data Communications Standards II
ElectronicsWeek Magazine Books
McGraw-Hill Intl. Publications Co.
European Circulation Center
Maidenhead, Berks. SL6 2QL,UK
(Tel. (0628) 23431; Telex 848640)

McGraw Hill

Send me ______ copy (copies) of R100-**DATA COMMUNICATIONS STANDARDS EDITION II** at $275. U.S. orders please add local sales tax. McGraw-Hill pays regular shipping and handling charges on prepaid orders. Ten-day money-back guarantee applies.

☐ Check enclosed ☐ Bill me ☐ Bill company
☐ Company Purchase Order enclosed.

☐ American Express ☐ Visa ☐ MasterCard
__________ Interbank No.
Credit Card No. ________________ Expiration Date ______

Name ____________________
Title ____________________
Company ____________________
Address ____________________
City ____________________
State/Zip (U.S.) ____________________
Country (outside U.S.) ____________________

ELV

UNIX GETS OFFICE-FRIENDLY

Operating system is popping up everywhere, as third-party software vendors create Unix-based blends for almost every need

☐ *by Ann Jacobs*

Unix operating systems have been marching steadily out of the laboratory and university environment and into offices, where the 16-bit microprocessor is king and 32-bit machines are invading the territory. Forced to overcome data-locking problems, and with a clouded reputation for possessing a user-unfriendly interface [see p. 47], Unix nonetheless has overcome some of these handicaps to become the environment for new business-applications software packages.

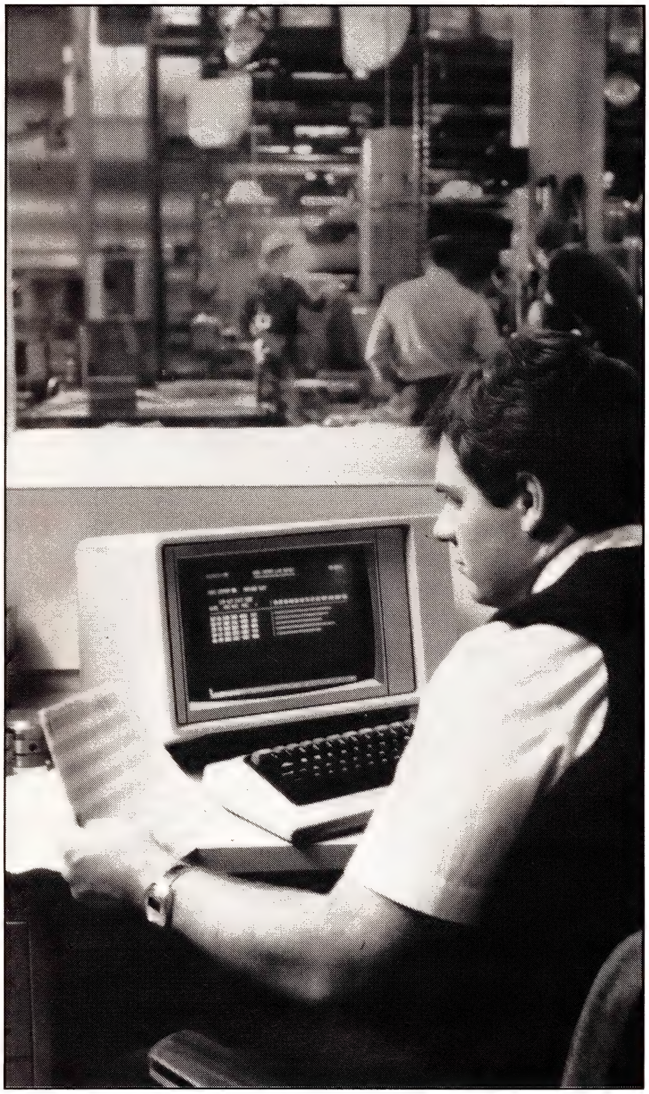
Integration is the goal. Initially, integrated packages could be divided neatly into two groups: those comprising word processing, graphics, and spreadsheets for personal computers; and those covering the mistily defined area of office automation, with features ranging from electronic and voice mail and messaging to networks of microcomputers linked to a central minicomputer.

But recent software introductions are crossing this line. Often, it is a case of packages for word processing or accounting being enhanced by network and communications facilities. But the tide flows freely in the other direction as well; some office systems are adding larger performance packages for the individual user.

Then there are the systems whose emphasis is marrying Unix to IBM Corp. Personal Computers and other manufacturers' hardware. Overall, the picture is one of flexible, total-document orientation with menus that are as user-friendly as a basket of puppies. The creative systems integrator has a wide range to choose from here.

Quadratron Systems Inc. has enhanced its Q-Office package (an early leader in integrated software), which includes calendar, spreadsheet, and a Wang-style word processor, with the Q-One graphics module. Q-One attaches the image to a specific point in the text; the image then floats with its identifier, or it can be anchored to a page, with the text flowing around the image. Quadratron has also added integrated voice and text messaging and a search-and-retrieval module called Q-File.

Sperry MBS (Manufacturing Business Solution) is a manufacturing-control system with integrated financial applications—it can be menu- or command-driven, at the user's choice. Designed by DBSI Information Systems Inc. for the Sperry line of computers, MBS offers ac-



Rough and ready. On the floor of a machine shop, the manager uses Sperry's Manufacturing Business Solution, which runs under Unix on Sperry computers, to display actual and planned shop loads.

Versatile. The Unix-based software from Interactive Systems Corp. running on the IBM Corp. Personal Computer does more than just the basics—the PC can act like a terminal on time-shared processors.

counts payable and receivable and general-ledger modules, transaction-history and year-end material, and rollover functions. For manufacturing, MBS contains on-line material-requirements planning, purchasing capability, and order processing.

Absolut Software's order-entry-inventory-billing system comes with optional accounting modules when the base package is purchased. Currently running on Plexus, AT&T 3B2 and 3B5, Pixel, and Convergent MegaFrame computers, the software is planned for a port to the IBM Corp. Personal Computer AT and other Xenix systems.

Emerald City Inc.'s Emerald One began life as Unidesk, an in-house electronic-mail service. It has retained a high emphasis on communications among workers, including "chatting," an interactive talk feature that fortunately also comes with a "do not disturb" mode. To this, the manufacturer adds word processing plus spreadsheet and graphics for an office-automation package.

Two recent releases extend the vendor's reach from Unix into IBM's PC/IX operating system, a Unix adaptation. Interactive Systems Corp. links time-shared processors and personal computers in such a way that the PCs can behave like intelligent terminals and auxiliary processors for the time-shared processor. From either machine, the user can send electronic mail and access data from anywhere in the network. Word processing is the basic package, and networks can include machines from IBM, Digital Equipment Corp., and SCI Systems.

Oracle Corp. goes forth to slay the blue dragon armed with a relational data base that runs all versions of Unix System V and Berkeley 4.2 (which supports virtual memory on DEC's VAX) releases, as well as a number of non-Unix proprietary operating systems. Oracle's announced goals are compatibility, connectibility, and portability for its word processing, spreadsheet, graphics, and network system. The SQL language is the common denominator, letting the user access IBM's SQL/DS and DB2 data bases.

Those who agree with Bill Joy, the father of Unix 4.2 BSD, that the future of computing lies in bit mapping should investigate Alis from Applix Inc., whose bit-mapped work station version offers overlapping windows that can be sized and positioned by the user. (There is also a version of Alis for character-oriented terminals.) Multiwindowing plus open architecture for free movement of text, graphics, and spreadsheet information into the document under preparation gives bit-mapped Alis unusual flexibility, Applix believes. The company has left the door open for scanned image and digitized voice capabilities to be added in the future.

Uniplex II contains word processing, spreadsheet, and data-base modules, with an application generator as an option. Its print spooler controls shared printers for applications with heavy hard-copy demands, and multiuser file locking is also a feature. Uniplex II has no less than 30 levels of menus that are integrated at the source-code level and operate across all application modules.

As Unix spars with proprietary operating systems, AT&T Co. has just announced a validation service for derivatives of Unix V and a "System V Interface Definition." Like a pair of shears, they are intended to work together to prune some of the wilder growth in the Unix shrubbery and give developers a sense of control and direction as they seek to make Unix the sole standard.

Meanwhile, the Independent Software Information Standard (ISIS) is still active, according to Val Skalabrin of Unify Corp., one of its creators. ISIS was built by Skalabrin and Unify president Nicholas Nierenberg; co-founders of the ISIS group are Access Technology and Quadratron. The standard provides a common data interface for third-party Unix applications. Circulated in spring 1984, the preliminary standard was approved at Fall Comdex. At present, more than 45 original-equipment manufacturers subscribe to ISIS, says Duke Castle, director of marketing for Unify, and with this momentum, ISIS is not to be ignored.

Quadratron Systems Inc., 15760 Ventura Blvd., Suite 1032, Encino, Calif. 91436. Phone (818) 789-8588 [Circle reader service number 460]

Sperry Corp., Information Systems Group, P.O. Box 500, Blue Bell, Pa. 19424. Phone (215) 542-4213 [Circle 461]

Absolut Software, 2001 Beacon St., Boston, Mass. 02146. Phone (617) 277-0610 [Circle 462]

Emerald City Inc., 20 Richmond St. E., Suite 700, Toronto, Canada M5C2R9. Phone (416) 863-9923 [Circle 463]

Interactive Systems Corp., 2401 Colorado Ave., Santa Monica, Calif. 90404. Phone (213) 453-8649 [Circle 464]

Oracle Corp., 2710 Sand Hill Rd., Menlo Park, Calif. 94025. Phone (415) 854-7350 [Circle 465]

Applix Inc., 112 Turnpike Rd., Westboro, Mass. 01581. Phone (617) 870-0300 [Circle 466]

Uniplex Integration Systems Inc., Suite 500, 1 Galleria Tower, 13355 Noel Rd., Dallas, Texas 75240. Phone (214) 851-4213 [Circle 467]

NEWCOMER BOARDS VMEBUS

Leaping into the crowded VMEbus market, Science Applications introduces 34 boards covering the full range of VME applications

☐ *by Tobias Naegele*

There are upward of 20 companies riding the crest of VMEbus popularity—Force Computers, Motorola, UTC Mostek, Data-Sud, Philips S&I—the list goes on and on like a who's who in electronics. The bus, crowded with the glamour boys of the industry, doesn't seem to have room for anyone else.

But now, from a far-off corner of Alabama and into the midst of the waiting crowd, Science Applications International Corp. is emerging as a bona fide contender with its Saivme series of boards. The new kid on the block is taking on the VME market with a line of 34 VME boards that can handle the full range of VMEbus requirements.

"We're planning on $1 million to $2 million in sales this year and double that the following year," according to Carl Leary, a sales representative at Science Applications' headquarters in Huntsville, Ala. Analysts estimate that VME-board sales netted about $50 million in 1984. Thus, a market share of the size that Science Applications expects would put the newcomer squarely among the top producers of VME technology.

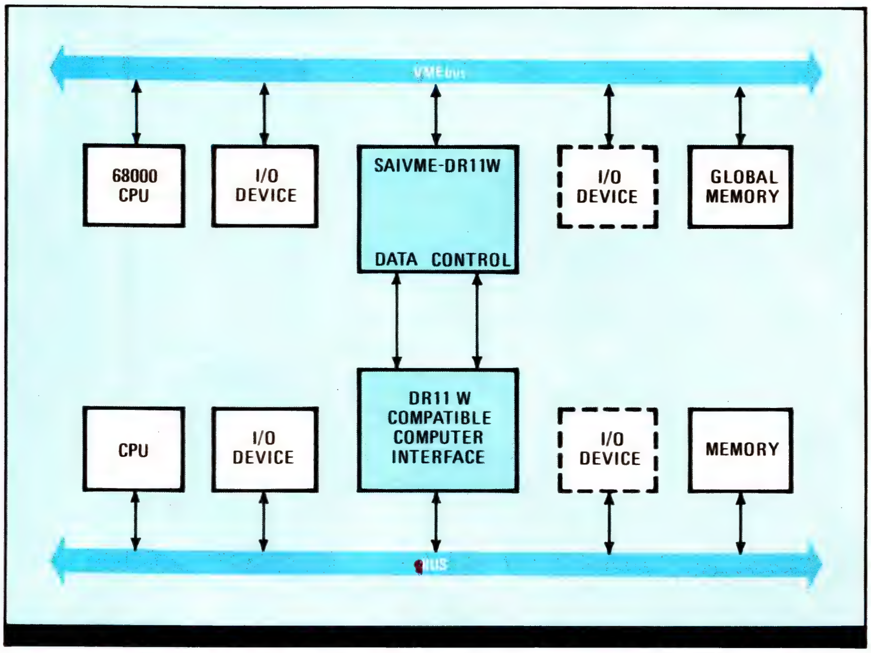
"If you look at our product line, 90% of what we've got, nobody else has," says Carroll Williams, manager of the company's Microsystems Division. "There are basically three problems with VME—host-computer interfaces, VME-to-VME links, and digital input/output [boards] that support 32-bit transfers. We've got all three."

The Saivme-HSD, a computer interface that links a VME system with the Gould/SEL HSD model 9132 host computer, provides a 32-bit direct-memory-access link between the VMEbus and the host, while supporting the computer's maximum data-transfer rate.

Incorporating a 68430 DMA controller chip to perform its DMA transfers, the $2,895 Saivme-HSD also contains logic to implement a VMEbus interrupter and logic to allow the bus to interrupt the board. The 68430 chip provides the logic required to control the VMEbus during transfers and to perform handshakes with the HSD.

An on-board programmable register allows 24-bit address mapping anywhere on the system. Built on a double-high Eurocard form-factor printed-circuit board, it supports both single-cycle and burst-mode operations on the VMEbus.

The Saivme-DR11W links the VMEbus with Digital Equipment Corp. DR11W peripherals and host interfaces, allowing simple, cost-effective solutions to several I/O problems. DR11W-compatible host interfaces that will connect with the bus board can be purchased for Prime, DEC, Perkin-Elmer, Data General, and Harris



Intermediary. Standing between the VMEbus and a host interface for Digital Equipment Corp. or other host systems, the Saivme-DR11W supports the maximum DR11W transfer rates.

How to keep from the electronic war.

being a casualty in

Is the electronics industry going the way of other industries?

There used to be 600 automobile manufacturers in the United States. Today there are four.

Once there was a brewery in every city. Today most of them are gone.

Today there are 200 personal computer manufacturers. How many will there be tomorrow?

The shakeout has started. Yesterday's darlings are today's disasters. Many companies have seen their reputations shattered. And the casualties continue to mount as competition intensifies.

Technology on a rampage.

Today's rampaging technology has done in many of yesterday's heros.

Such was the case when the 16 bit technology wiped out the computer companies still working with 8 bit technology. Or when the marketplace gave the VCR the nod over the videodisc.

Some say PBX technology will replace local area networks. And CMOS will overrun NMOS. And laser optical networks will challenge satellites.

Where do I get my Edsel serviced?

Customers are concerned. Nobody wants an orphan. Who wants to be stuck with a product without service, without spare parts, without product enhancements?

What customers do want in today's fast-changing marketplace are "credentials". They want assurance that the company they're buying from will be around after the smoke clears.

Survival requires better decisions on such things as technology, positioning, marketing and distribution. Decisions that have to take into consideration not only other U.S. companies, but global competitors as well.

ElectronicsWeek to the rescue.

The old days are gone forever. That's why more and more decision makers turn to ElectronicsWeek.

Recognizing and analyzing important trends in technology is the most important way ElectronicsWeek contributes to the "better" decision making process. That's because today's winners are those companies that anticipate the technological zigs and zags of the marketplace.

The voice of the industry heard every Monday.

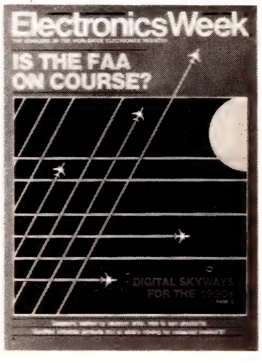
ElectronicsWeek utilizes the largest news bureau system in the industry to provide its readers with timely technical analysis and information. (We're the only electronics magazine with full-time editorial bureaus in Japan, London, Paris and Frankfurt.)

It's our world-wide perspective that attracts readers from every part of the globe. If you're not one of them, perhaps you should be.

Subscribe today. It isn't going to get any easier out there on the electronics-battlefield.

Call toll-free 1-800-257-9402 or write ElectronicsWeek, CN 807, Martinsville, N.J. 08836.

A one-year subscription in the U.S. is just $32.



An Alternative for Advertisers to Reach Design Engineers

Editorial:

Computer Systems Equipment Design is devoted entirely to international coverage of the computer segment of the electronics industry. It is produced by a team of experienced technical editors dedicated to providing readers with the most complete and accurate technical information available. A typical issue includes detailed technical articles focusing on significant trends or techniques authored by industry experts, provides in-depth technical articles and introduces new products.

Circulation:

25,000 qualified electronic design engineers specifically responsible for the design and manufacture of computers and computer systems, worldwide.

1985 Rates

	1x	12x	36x
1 page:	$2,050	$1,890	$1,810
2/3 page:	1,540	1,420	1,360
1/2 page:	1,270	1,175	1,120
1/3 page:	820	755	725
1/4 page:	655	605	580
1/6 page:	450	415	400

Cover rates	
2nd cover:	$2,850
3rd cover:	2,750
4th cover:	3,050

Color charges:	
Two color, standard:	$305
Matched 2nd color:	510
4 color process:	610
4 color process spread:	950

Issue and Closing Dates:

Issue Dates	Closing Dates
January 1, 1985	December 1, 1984
March 1, 1985	February 1, 1985
May 1, 1985	April 1, 1985
July 1, 1985	June 1, 1985
September 1, 1985	August 1, 1985
November 1, 1985	October 1, 1985

No Waste Circulation:

Computer Systems Equipment Design is a targeted and cost-efficient way to get your advertising read by computer and computer systems design engineers, worldwide.

For space reservations, call Production Dept., McGraw-Hill Electronics Publications, (212) 512-3140, 1221 Avenue of the Americas, New York, N.Y. 10020.

McGraw-Hill

computers. The $1,595 DR11W board includes a 16-bit DMA controller and supports programmable modifiers on a 24-bit address range, and programmable interrupt levels and vector interrupts.

Another option open to users is the use of a pair of Saivme-DR11Ws merged to form a 2.25-megabyte/s VMEbus-to-VMEbus link. The board is just one of four of Science Applications' new boards capable of VME-to-VME linkage.

Williams predicts that 95% of the sales of Saivme-DMA, billed as a general-purpose DMA interface, will be for VME-to-VME links because of its high 8-megabytes/s transfer rate. The same 68430 DMA chip used in the Saivme-HSD performs the board's DMA transfers and supplies the logic during transfers to control the VMEbus.

Like the VME-DR11W, the DMA board can be used to link two VMEbuses; if both buses use a 32-bit data path, the interface can perform 32-bit transfers. The 68430, software-compatible with the 68440 and 68450, also provides the added capability of performing 32-bit transfers in a single cycle. List price for the Saivme-DMA is $3,695.

The product line also includes boards designed for analog I/O and synchro/resolver functions. Among the I/O series, these include 32- and 64-channel multiplexers and a high-speed 40-kHz analog-to-digital converter with an on-board multiplexer; among the synchro/resolver boards, several are equipped with built-in test logic to support fault isolation at the card level.

Almost all of Science Applications' 34 VME boards are available now, but some may require up to 90 days for delivery.

Science Applications International Corp., VME Microsystems Division, 2109 W. Clinton Ave., Huntsville, Ala. 35805. Phone (205) 533-5900 [Circle reader service number 338]

Flexible vision system is complete for $14,500

The IntelleVue 200 can act as a stand-alone inspection system or can be mounted on automated equipment for guidance applications. It is programmable off-line with a simulator, can be used with fixed or wrist-mounted cameras when working with robots, and accepts plug-in options for memory or function expansion. It is compatible with the SECS II communications protocol.

Based on the 8086 and 8087 processors, the system offers gray-scale and binary vision with windowing. Also offered are connectivity analysis and pixel counting. Images are recorded in 1/30 of a second. The system runs on a proprietary version of Basic with more than 120 vision-specific commands. It can be programmed with a terminal or with an IBM-compatible personal computer.

The $14,500 unit includes vision electronics, solid-state camera, monitor, and operator manual. In addition, terminals and Compaq Computer Corp. personal computers as well as additional memory and solid-state cameras can be provided. Delivery takes 30 days.

Intelledex Inc., 4575 S.W. Research Way,
Corvallis, Ore. 97333.
Phone (503) 758-4700 [Circle 364]

Compact, portable emulator develops software for 68000

The SA700-68K in-circuit emulator is designed for the Motorola Inc. 68000 microprocessor. This compact and portable integrated system comes in a package no larger than a portable personal computer.

The system combines software development capability with a 68-K-byte mini-assembler, a real-time 10-MHz in-circuit emulator, a CRT display, a fold-down ASCII keyboard, an 8-in. floppy-disk drive, and a built-in PROM programmer. The SA700-68K measures 7 in. high by 16 in. wide by 19 in. deep, and weighs in at 33 lb. It can be serviced in the field, says the manufacturer.

Thanks to a batch-debugging command language, the user can develop and execute entire debugging routines on the emulator—an improvement over other emulators that require commands to be entered individually on the host computer.

The system consists of a pair of CPUs—a Z80, for real-time emula-

Rise to the top of the heap, by putting yourself at the top of the list.

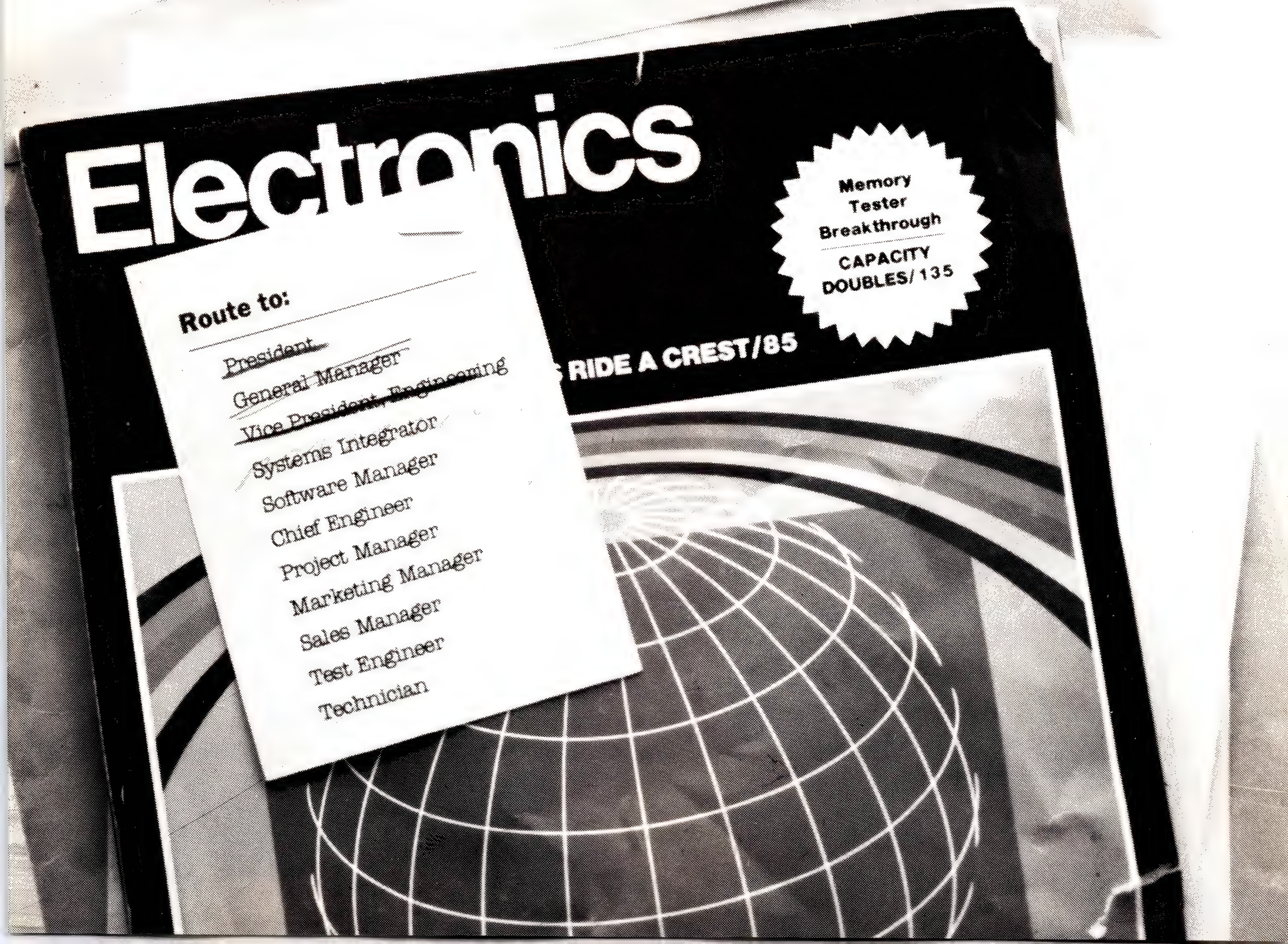
It's tough getting ahead when you're always getting a week-old ElectronicsWeek.

Now you can stay on top by receiving your own copy. Timely and up-to-date. Addressed to you personally.

Tired of being one of the last to know what's happening in the industry? In the ever-changing electronics industry, you can't afford to be left out in the cold.

Don't hesitate. Fill out the subscription card now. If there is no subscription card, please write to: ElectronicsWeek, CN 807, Martinsville, NJ 08836 or call toll-free 800-257-9402 ext. 14 (in New Jersey, call collect 609-426-5330 ext. 14). Outside U.S., please write to: Subscription Dept., European Circulation Center, Maidenhead SL6 ZQL, England.

Rise to the top of the list. And the top of the heap.



Survival in the electronic 80's requires better decisions, not just better designs.

With the recent bankruptcies of many hi-tech ventures, more companies are coming to the painful realization that the old days are gone forever. Today, even a well-designed product may fail in the marketplace.

That's why more and more decision makers turn to ElectronicsWeek. The magazine that helps them come up with better decisions, not just better designs.

Analyzing the impact of technology.

Recognizing and analyzing important trends in technology is one of the ways we contribute to the "better" decision making process. Because the winners in today's electronics industry are those companies that use this information to help them anticipate the technological zigs and zags of today's highly competitive marketplace.

Voice of the industry, heard every Monday.

Every Monday, ElectronicsWeek utilizes the largest news bureau system in the industry to provide its readers with timely technical analysis and information. (We're the only electronics magazine with full-time editorial bureaus in Japan, London, Paris and Frankfurt.

It is this worldwide perspective that attracts subscribers from every part of the globe. If you're not one of them, perhaps you should subscribe.

Do it today. It isn't going to get any easier out in the jungle.

McGraw Hill

ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

INDUSTRY'S VERDICT:

A GOOD YEAR AHEAD

Enter the new era of MICROSYSTEM DESIGN

MICROPROCESSOR SYSTEMS: Software and Hardware Architecture delivers a wealth of information about microcomputers, peripherals, networks, signal processing and software, that leads the field in the 80's!

This book is a comprehensive collection of technical articles, carefully detailed and presented, in exclusive reprints from *Electronics* Magazine.

Corporate Managers, Project Managers, Design Engineers, Market Managers: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** is one book for all!

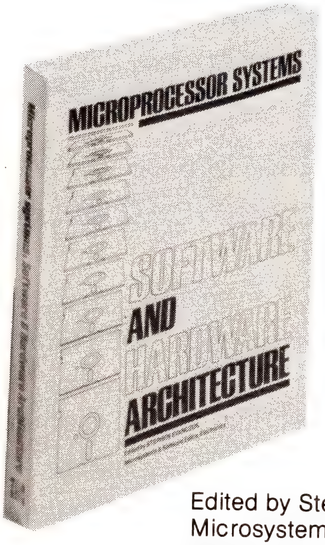
Six knowledgeable chapters examine:

- Significant trends in the development of new software systems and applications
- Technical articles on the manufacture of new microprocessors
- Approaches to memory management used by major chip manufacturers
- Conveniences of peripheral chips
- Alternative network methods from Ethernet to token-passing protocols
- Modular procedures for making digital signal processing systems

Engineers – Save precious time by eliminating a cumbersome series of software instructions.

Directed chiefly at design tactics, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** helps you avoid errors and overcome all your architectural problems.

- Brings you the needed simplicity of design, without sacrificing performance of the finished system
- Offers a means of tapping microsystems into the power of mainframe machines
- Recounts major breakthrough in dedicated chips that handle math operations in record time



Edited by Stephen Evanczuk,
Microsystems & Software
Editor, *ELECTRONICS*

In one resourceful volume, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** lets you understand:

- Functions of hour end microprocessors and controllers
- Key microprocessors that trigger the personal computer revolution
- The importance of dedicated chips more sophisticated than mainframes of yesteryear
- Significant aspects of microcomputer software
- Efficiency of peripheral-control chips

Here it is –

MICROPROCESSOR SYSTEMS: Software and Hardware Architecture - Let it design for you!

Don't be left in the dark: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** illuminates the design process of an ever changing industry.

Don't delay -- order your copy today!

Use the coupon or send in your company purchase order.

MC GRAW-HILL PUBLICATIONS CO.
Attn: ECC
McGraw-Hill House
Maidenhead, Berkshire SL6 2QL
England
(Tel. (0628) 23431; Telex 848640)

Send me ________copy(ies) of MICROPROCESSOR SYSTEMS: Software and Hardware Architecture for $21.95 each. (U.S. residents please include local sales tax).

☐ Payment enclosed (postage & handling included)
☐ Bill me (postage, handling & tax will be added) NOTE: All orders under $30 will be sent a pro forma invoice requiring prepayment.
☐ Bill my company. Purchase order is attached.

Ship to:

Name ____________________

Company ____________________

Street Address ____________________

City__________State________Zip________

Country ____________________

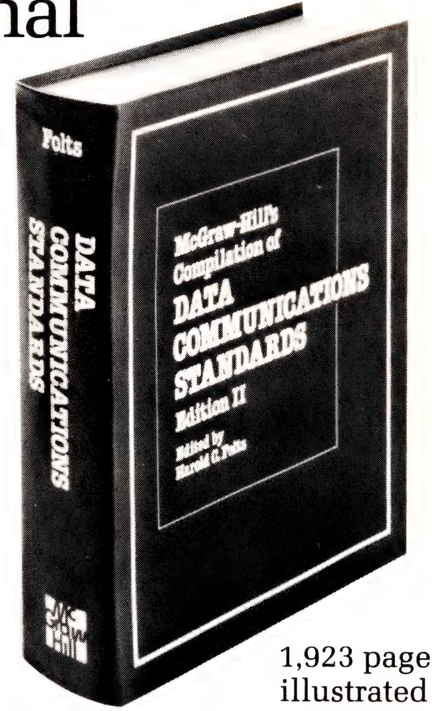
McGraw-Hill knows you will be satisfied, but if for some reason you are not, there is a ten-day money-back guarantee that applies on all books. Allow four to six weeks for delivery.

NEW EDITION

Complete and Unabridged American and International

DATA COMMUNICATIONS STANDARDS

All standards are new, revised, or reaffirmed since the previous edition


Folts
DATA COMMUNICATIONS STANDARDS
McGraw-Hill's Compilation of
DATA COMMUNICATIONS STANDARDS
Edition II
Edited by Harold C. Folts
McGraw-Hill

1,923 pages illustrated

Presents all 123 interface protocol standards set by:

- International Telegraph and Telephone Consultative Committee (CCITT)
- International Organization for Standardization (ISO)
- European Computer Manufacturers Association (ECMA)
- American National Standards Institute (ANSI)
- Electronic Industries Association (EIA)
- U.S. Government (NBS and NCS)

Special feature for instant access:
Cross-reference tables of the similar and interfacing standards of each group corresponding to those published by the others.

Edited by Harold C. Folts, the leading consultant on data communications standards and an active participant in the development of U.S. and international standards.

Published jointly by *Data Communications* and *Electronics* magazines.

An essential reference for designers, planners, operations managers, and all organizations exploring, developing, manufacturing, or using data communications equipment or networks.

Don't waste time and effort! With this landmark resource you can quickly and accurately determine exactly which standards apply to the project at hand, and speedily integrate those standards into your own data communications equipment or network plan.

Order your copy today!

Data Communications Standards II
ELECTRONICS WEEK BOOKS
McGraw-Hill Intl. Publications Co.
European Circulation Center
Maidenhead, Berks. SL62QL, UK
(Tel. [0628]23431; Telex 848640)

Send me____ copy (copies) of **DATA COMMUNICATIONS STANDARDS EDITION II** at (U.S.) $250. McGraw-Hill pays regular shipping and handling charges on prepaid orders. Ten-day money-back guarantee applies.

Ship To:
Name______________________________
Title______________________________
Company______________________________
Address______________________________
City______________________________
Country______________________________

☐ Check enclosed. ☐ Send Proforma Invoice

Payment must accompany order for immediate shipment.

tion, and a 68000, which is emulated at up to 10 MHz. The user is provided with 64-K bytes of static RAM and 256-K bytes of dynamic RAM. Also included in the package are an RS-232-C port for serial communication, a Centronics-compatible parallel port, and an optional RS-422 high-speed serial port.

Available immediately, the SA700-68K in-circuit emulator sells for $11,995.

Sophia Computer Systems Inc., 3337 Kifer Rd., Santa Clara, Calif. 95051. Phone (408) 733-1571 [Circle 361]

Multiplexers transmit data, voice, and video cheaply

A trio of products promise the corporate data network more cost-effective data, voice, and compressed video communications. The multiplexers reduce line costs by combining channels into a single transmission facility. Each will work with the firm's Dataphone II Level IV network diagnostic and management control system.

The 718 Stat Mux is a statistical multiplexer that can handle from 4 to 32 modular channels of asynchronous and synchronous data. Each channel carries data at up to 9.6 kb/s. Coaxial, fiber-optic, satellite, and metallic transmission facilities can be used with this device. Price ranges from $3,200 to $9,000.

The 719 Networker is a combination statistical multiplexer and data-packet switcher for routing multiple remote locations in a central control. The stand-alone 32-channel computer port is priced from $5,000 to $19,000.

The 735 T-Mux is a time-division multiplexer for medium-sized to large businesses with the voice and data traffic to justify a T-1 facility. The main unit can accommodate up to 64 channels, or 128 channels with an expansion unit. The price starts at $11,000 and runs up to $72,000 for a fully redundant, 128-channel unit.

AT&T Co., 100 Southgate Pkwy., Morristown, N.J. 07960.
Phone (201) 898-8326 [Circle 368]

Single-chip DRAM controller eliminates wait states

A single chip combining all dynamic-RAM drive functions, the DP8419 single-chip 256-K DRAM controller/driver from National Semiconductor includes on-chip address multiplexers, delay lines, on-board high-capacitance drivers, and a refresh counter. This large-scale integration DRAM controller/driver works with all major CPUs at 10 MHz or above without wait states, the company says.

Projected to replace discrete-logic controllers for addressing and driving more than 2 megabytes of RAM, the DP8419 can also be employed to allow the use of slower and less expensive 256-K RAMs in systems using lower-speed microprocessors.

The DP8419's high-speed low-power advanced Schottky design features enhanced timing-control capabilities such as accurate automatic sequencing of RAM-access timing and automatic control refreshing.

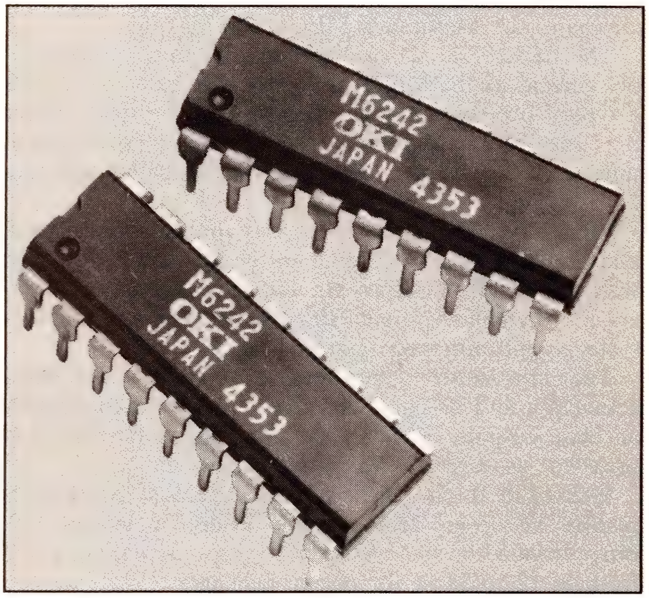
Production quantities of 100 to 999 sell for $47.25 apiece and will be available in May. The chip, packed in its standard 48-pin plastic DIP, is available in prototype quantities immediately; 48-pin, gold, side-brazed, ceramic packed models will be available later.

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, Calif. 95051. Phone (408) 721-5000 [Circle 357]

IC timer chip connects to CPUs

Identifying the year, month, day, hour, minute, and second, the MSM6242RS is a low-power CMOS IC clock that can be connected directly to a CPU through a bus.

Developed by Oki Semiconductor for a wide range of microprocessors, the time chip offers the user a choice of either 12- or 24-h formats and such other features as automatic adjustment for leap years and a time-counting feature that can be started and stopped on command.



The MSM6242RS, which operates on a standard 5-V power supply and draws only 30 mA, can be connected to a backup battery and a 32.768-kHz crystal for protection against loss of continuity in the event of a power failure.

Guaranteed for normal operaton from –30°C to +85°C, the chip is packaged in an 18-lead plastic DIP. In lots of 100, the clocks are $4 each.

Oki Semiconductor, 650 North Mary Ave., Sunnyvale, Calif. 94086. Phone (408) 720-1900 [Circle 355]

DMA controller maximizes performance and throughput

At rates approaching the limits of the host memory bus, the MC68450 Direct Memory Access Controller from Motorola performs memory-to-memory, memory-to-device, and device-to-memory data transfers.

With transfer rates of up to 5 megabytes/s at 10 MHz, the MOS-based controller supports all of the bus options of the M68000, such as halt, bus error, and retry. The chip increases throughput because the system processor can handle direct memory access and other operations at the same time.

The MC68450's four independent DMA channels offer programmable priority at levels from 0 through 3; if requests of the same priority level occur concurrently, the chip uses a round-robin arbitration scheme to select a servicing order.

Available now in 64-pin ceramic DIPs, the chips cost $78.43 each in lots of 100. Ceramic pin-grid-arrays and plastic DIPs will also be available later this year.

Motorola Semiconductors, 3501 Ed Bluestein Ave., Austin, Texas 78721. [Circle 356]

1-ns ECL circuits consume just 25 mW/gate

A series of 12 high-speed ECL chips, the ECL10KH chips from Monolithic Memories are fully pin-compatible alternates for Motorola's MECL10KH family.

The ECL10KH series maintains the same power-supply current as the Motorola MECL10K parts but boasts a typical propagation delay of just 1 ns, versus 2 ns for the older Motorola part. With a maximum rise-and-fall time of 2.2 ns (1.6 ns typical), power dissipation averages 25 mW/gate.

Monolithic Memories' chips are voltage-compensated, allowing guaranteed dc and switching parameters, and were specifically designed for high-performance computers and peripherals, digital signal-processing and graphics systems, and automatic test equipment.

The chips feature complementary outputs, which allow a function and its complement to appear simultaneously at chip outputs, and reduce power requirements and problems associated with timing differential.

Housed in 16-pin plastic or ceramic DIPs, the 12 units require 12 weeks' delivery time. Prices, in lots of 100, range from $1.42 to $6.84 each for ceramic packages and from $1.18 to $5.91 for plastic packages.

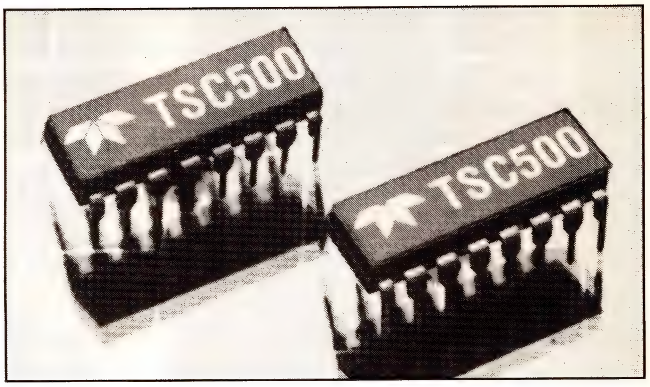
Monolithic Memories, 2175 Mission College Blvd., Santa Clara, Calif. 95054-1592. Phone (408) 970-9700 [Circle 354]

Single-chip ADC offers flexibility and savings

Containing all the analog circuits that are necessary to make a dual-slope integrating converter, the TSC500 precision analog-to-digital converter is a single-chip building block.

With only a change in software, the TSC500 can be used in applications that require either 8- or 14-bit resolution. Standard operation is rated at a resolution of 50 parts per million on a ±5-V power source. The chip requires a maximum power of only 15 mW, according to the manufacturer.

The on-chip features of the CMOS TSC500 ADC include an input buffer, integrator, analog switches, and comparator. Thanks to the chip's three digital interface lines, a microprocessor can control the conversion while two lines set the converter into one of four cycles. They are auto-zero, signal integrate, reference deintegrate, or integrator zero.



The converter can be used in several different techniques, such as dual-slope conversion and integrating conversion. The CMOS design makes it possible to configure a TSC500-based microprocessor-controlled intelligent measurement system.

In either plastic or ceramic 16-pin DIPs, the chip is available now in sample quantities. Production quantities of 100 or more take 8 to 10 weeks for delivery and are priced at $5.20 each for plastic and $6.80 each for Cerdip packages.

Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, Calif. 94043. Phone (415) 968-9241 [Circle 358]

Inexpensive 8-bit ADC performs at high speeds

Coming in at one third the price of comparable parts, the 8-bit TLC549 analog-to-digital converter from Texas Instruments can perform up to 38,000 successive-approximation conversions per second.

The ADC's LinCMOS processing and switched-capacitor design process allows the construction of capacitors that are smaller, more accurate, and of higher capacitance than is possible using metal-gate CMOS designs, the company says. Capacitors based on this technology are typically 10 times smaller than those based on the metal-gate process.

The TLC549's use of a switched-capacitor design instead of the ladder-resistor technique saves space and power, the company says. It comes in 8-pin DIPs or in small-outline packages for $1.58 each.

Texas Instruments Inc., Semiconductor Group, Literature Response Center (SC-472), P.O. Box 809066, Dallas, Texas. 75380. Phone (800) 232-3200, ext. 700 [Circle 360]

A 10-bit CMOS DAC settles in 600 ns

The first CMOS product from Precision Monolithics, the PM-7533 monolithic 10-bit digital-to-analog converter, fits directly into the industry-standard AD7533 and AD7520 sockets.

Advantages over existing DACs are improved power

WE SHIP PRODUCTS...NOT PROMISES™

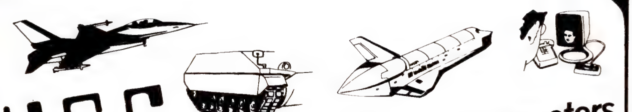
Send for Complete Electronic Components Catalog. Keystone Products Are Available From Your Local Distributor.

DESIGNERS MANUFACTURERS K **KEYSTONE ELECTRONICS** CORP.

49 Bleecker Street, New York, NY 10012 • Tel: (212) 475-4600 TLX: 35-3700 • Call Toll Free: (800) 221-5510 ©

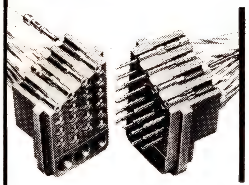
Circle 71 on reader service card

See Us at Booth 4628, Electro '85



U.S.C.

Precision Engineered Electronic Connectors



for critical applications in military, naval & aero-space communication, detection and actuation systems.
WE MAKE THEM ALL!

UPCR Printed Card Receptacles (.100, .125, .156 spacings)
IMI-MH Miniature Connectors (MS & others; Miniature Hex)
REMI RE-entrancy Miniature crimp-type connectors
UPCC-RECP Two-Unit P.C. Connectors (.156, .100 spacings and co-ax)
980-990 Power Connectors
URC Miniature Power Con-clip connectors (size 16, 20 contacts)
MIG-WG-MPC Two-Unit P.C. Connectors (.100 spacing; solder, dip-solder, removable crimp)
UMI-RUMI Ultra-Miniature Connectors
UMG Two-Unit P.C. Connectors (.100 spacing; solder, dip-solder, removable crimp)
SMI SubMiniature Connectors
USC connectors meet all applicable Mil-Specs

FOR DETAILED CATALOGS PHONE OR WRITE

1-800-TELL USC
NYS 1-516-589-8080
U.S. COMPONENTS, INC.
35 Carlough Rd., Bohemia, NY 11716
TWX 510-228-7886
Cable Address: COMPONENTS NYK

Circle 95 on reader service card

Ever notice how some people always seem to have the right answer? No matter what the situation, they always seem to be a step ahead.

And they're successful...the first in line to lead an important project...the first in line for a promotion. It's certainly not magic. Usually it's a combination of hard work, brains, guts and desire.

It probably means they read ElectronicsWeek... regularly.

ElectronicsWeek has helped propel many a manager and engineer to the front line...to the "leading edge" of the industry. And just as we've been providing many of your colleagues with the right information, the *important* information–when they need it most–so too can we provide it for you.

Every week an ElectronicsWeek subscriber receives an issue crammed with the latest information on new products, developments, concerns and trends in the worldwide electronics industry.

When you become a subscriber, we'll supply you with the intelligence you need to make the big decision, or the every day decision to further your career and reap profits for your company. For a taste, just browse through the issue you're holding.

But, you really don't have to believe us. Just ask the person who's always a step ahead.

To become a subscriber, just complete and mail the insert card in this magazine. If subscription card is missing, write: Circulation Manager, ElectronicsWeek, P.O. Box 511, Hightstown, N.J. 08520.

ElectronicsWeek
The Voice of the industry

McGraw Hill

supply rejection, lower gain drift, and less integral and differential nonlinearity drift over temperature, the company says. No laser trimming is necessary to achieve true 10-bit accuracy.

Temperature tracking is improved by the use of an "on" n-MOS current-steering switch, connected in series with the R-2R ladder-terminating and feedback resistors. Full-scale output current on the latchup-resistant PM7533 settles to ±½ least significant bit in 600 ns. TTL- or CMOS-compatible, the DAC accepts inputs ranging from 5 to 15 V.

The converter is available now in 16-pin hermetically sealed ceramic DIPs for military, industrial, and commercial temperature-range applications; plastic packages will be available by midyear.

Pricing for 100-piece quantities ranges from $4 each for the 1-LSB commercial-grade part to $17.24 for the ½-LSB military-grade version. Delivery is from stock.

Precision Monolithics Inc., 1500 Space Park Dr., Santa Clara, Calif. 95050. Phone (408) 727-9222 [Circle 359]

Network-control system offers flexibility

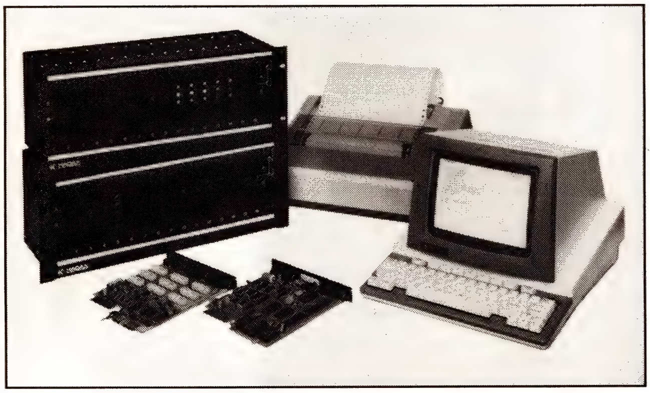
A variable and upgradable system, Hadax Electronics' Network Control Switching System locates and identifies network problems on screen and provides a fast means of bypassing faulty lines or modems and restoring service.

The system can be configured with up to 64 racks, each of which is fitted with 16 cards, for a maximum of 1,024 channels. These can be accessed, switched, and monitored with a dumb terminal. A monitor bus provides accessibility to any of the RS-232-C cards in the network for monitoring and testing.

Three programmable, on-screen audio/visual alarms help monitor a trio of Electronic Industries Association signals for this system, which boasts the industry's largest selection of channel interfaces.

The menu-driven network controller features report-printout capability and a battery-backup system designed to protect the system memory in the event of a power failure. Magnetic latch relays automatically lock the system into the last switched position when the power supply is cut.

Prices begin at $3,200 for a single-rack configuration, and each additional card sells for about $200. The switching system is available now for immediate delivery.



Hadax Electronics Inc., 79 Hazel St., Glen Cove, N.Y. 11542. Phone (516) 676-3386 [Circle 362]

Network-management system uses graphics to speed repair

Utilizing color-graphics displays and an extensive array of network diagnostic units spread throughout the system, the Medius Network Management System from Ocean Data Systems is claimed to be the most intelligent system in its class.

Built around a central-site network-management system that includes a Digital Equipment Corp. VAX processor, a logging printer, and an operator work station, the system depends on the network diagnostic units for automatic monitoring of network circuits.

System software includes facilities for automatic fault detection and analysis and an interactive color-graphics display of system and subnetwork status. The software also handles centralized control of diagnostic tests, control of local and remote switches, and collection and display of network-performance statistics.

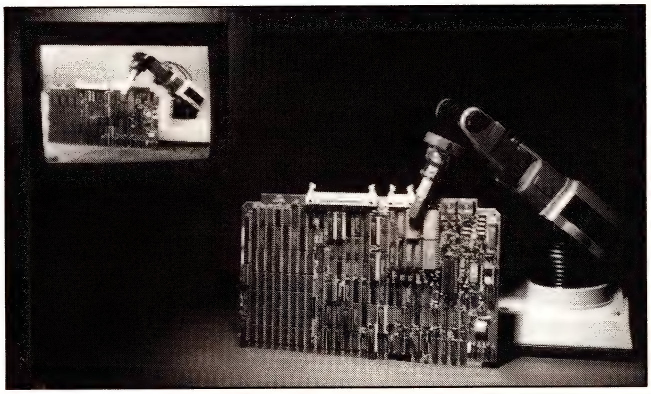
The interactive graphic viewing system speeds repair, the company says, because it simplifies troubleshooting. It operates on three levels: a full geographic user-definable overview of the entire network; schematic representations of user-specified subnetworks; and network details to show configurations of individual devices, such as modems, switches, or control cards, at any specific site.

A typical 96-circuit configuration sells for about $135,000, with additional circuits averaging about $1,200 to $1,400 each. The system, which includes user training, is available immediately.

Ocean Data Systems Inc., 6000 Executive Blvd., Rockville, Md. 20852. Phone (301) 881-3031 [Circle 363]

Image processor sits on a single Multibus board

Housed on a single Multibus board, the MIP-512 image processor provides full 8-bit data acquisition, 8-bit image storage and display, and image processing at 90 ns per pixel. An 8-bit flash analog-to-digital converter is used for digitizing an external video signal to 256 discrete intensity levels. Either external or internal synchroniza-



tion generation lock is software selectable. On-board programmable offset and gain controls and input lookup tables are provided for real-time preprocessing of raw video data.

The board contains 256-K bytes of dual-ported video RAM for storing images up to 512 by 512 by 8 pixels. Images can be transferred between the Multibus and the video memory under direct-memory-access control in a fraction of a second. The processor supports instantaneous pixel-by-pixel panning, scrolling, and zooming of images. Up to 256 colors or shades of gray can be displayed.

Delivered from stock, the MIP-512 sells for $2,995.

Matrox Electronic Systems Ltd., 1055 St. Regis Rd., Dorval, Quebec, H9P 2T4 Canada. Phone (514) 685-2630 [Circle 365]

Hardware digitizes video signal in real time

Two boards, one a video I/O analog subsystem and the other a memory-mapped digital storage unit, work together to convert a video signal into an image of 512 by 512 by 8 bits in 1/30 s.

The Multibus board set, the RTI-500M, is designed to couple to the manufacturer's optional high-speed pipeline image processor. Applications include inspection, surveillance, infrared thermography, microscopy, and the like.

The analog subsystem (AS-501M) can be connected directly to a video source without external hardware or signal-conditioning circuits. The digital storage unit (DS-501M) then stores the image and performs such manipulations as pixel panning, scrolling, 2× zooming, and write protection.

Prices for the RTI-500M board set start at $5,000 in quantities of 100. Delivery is from stock.

Recognition Technology Inc., 335 Fiske St., Alco Park, Holliston, Mass. 01746. Phone (617) 429-7804 [Circle 366]

Video board melds variety of software

When the PC-1200 is plugged into an expansion slot on the IBM Corp. Personal Computer or compatible, it opens up applications-software options that include Imigit, an image creator and editor; data-base and image integration using dBase II, the IBM Filing Assistant, and others with PhotoBase; and the Halo graphics library.

Graphics-adapter cards supported by the video digitizer board include those from IBM, Hercules, and Tecmar, as well as the GA-3 Revolution card with a palette of 16.7 million colors. The board will accept input from any NTSC, RS-170, or RS-330 color or monochrome video source, including VCRs and laser disks.

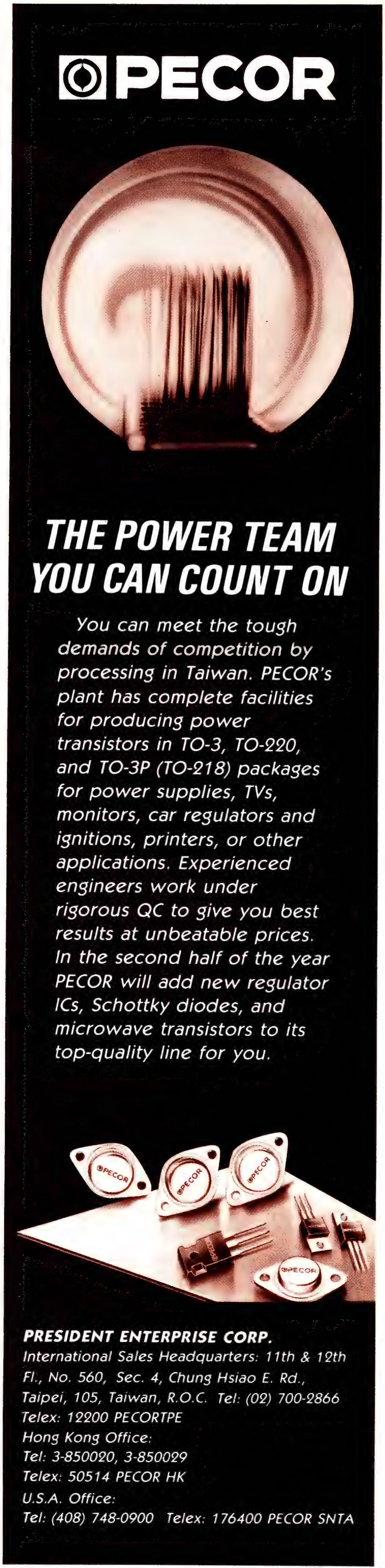
The PC-1200 board can present images in 256 levels of gray or color, capturing an image of 640 by 480 by 8 bits in 0.6 s. The programmer can manipulate images in full and partial resolution or at the row and pixel level. Extended functions include image compression, image comparison, and printer support.

Delivery of the PC-1200 takes about two weeks. The price of the 8-bit video digitizer is $1,495; 4- and 6-bit models are also available.

Chorus Data Systems, 6 Continental Blvd., P.O. Box 370, Merrimack, N.H. 03054. Phone (603) 424-2900 [Circle 367]

Data collector captures employee, inventory records

The microcomputer-based Netmaster, a data-collection system, offers application-specific packages of hardware and software to keep employee, inventory, and quality-control records. The Netmaster, the 16-bit central microprocessing unit, can be connected to up to 96 of the system's Transactor terminals. Depending on the

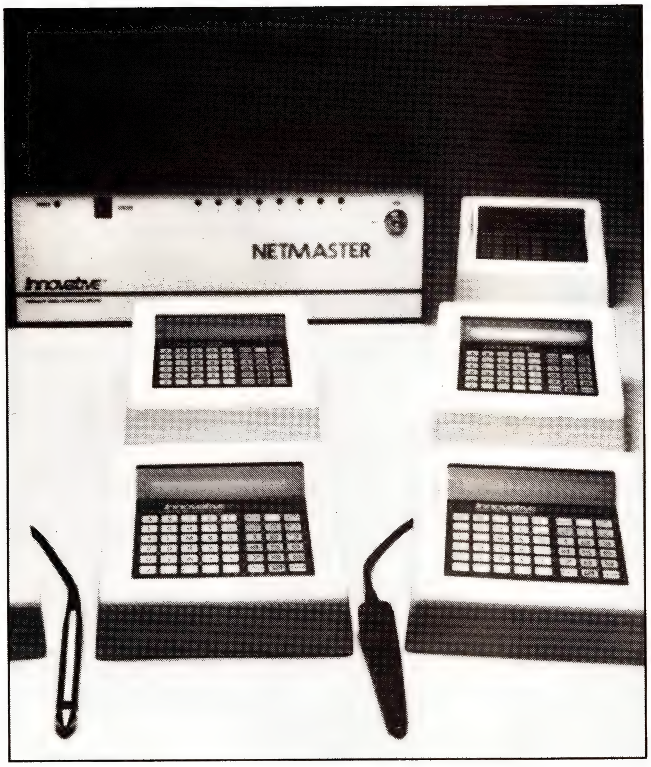

PECOR

THE POWER TEAM
YOU CAN COUNT ON

You can meet the tough demands of competition by processing in Taiwan. PECOR's plant has complete facilities for producing power transistors in TO-3, TO-220, and TO-3P (TO-218) packages for power supplies, TVs, monitors, car regulators and ignitions, printers, or other applications. Experienced engineers work under rigorous QC to give you best results at unbeatable prices. In the second half of the year PECOR will add new regulator ICs, Schottky diodes, and microwave transistors to its top-quality line for you.

PRESIDENT ENTERPRISE CORP.
International Sales Headquarters: 11th & 12th Fl., No. 560, Sec. 4, Chung Hsiao E. Rd., Taipei, 105, Taiwan, R.O.C. Tel: (02) 700-2866
Telex: 12200 PECORTPE
Hong Kong Office:
Tel: 3-850020, 3-850029
Telex: 50514 PECOR HK
U.S.A. Office:
Tel: (408) 748-0900 Telex: 176400 PECOR SNTA

Circle 73 on reader service card



manager's needs, the central unit and terminals offer variable memory capacities and input features, respectively. The processing unit can either stand alone or serve as a monitor between the terminals and a host computer for data-intensive uses.

Part of the system's software is application-specific. The custom software can cost between $5,000 and $15,000. Each Netmaster unit includes the operating system, the data-collection subsystem, the Transactor process routines, and the host communications system.

The price of the Netmaster depends on its memory: one with a 360-K-byte floppy-disk drive costs $8,000, two 360-K-byte drives cost $9,200, and a unit with one 10-megabyte drive and a 360-K-byte drive lists for $15,500. A Transactor costs $900 with just a keyboard, $1,000 for just bar-code entries, and $1,350 for both.

Innovative Electronics Inc., 4714 N.W. 165th St., Miami, Fla. 33014. Phone (305) 624-1644 [Circle 376]

MOS FET switcher supplies 175 W with four outputs

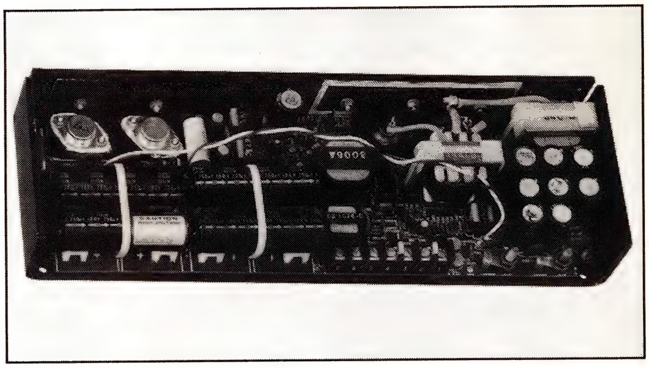
Computers, peripherals, and other office equipment are among the applications for a four-output, 175-W switching power supply built using MOS FET technology. The unit has a 50-kHz switching frequency and built-in brownout protection. The switcher meets international electromagnetic-interference and safety requirements set by Underwriters Laboratories, the Federal Communications Commission, Canadian Standards Association, and the International Electrotechnical Commission.

At outputs 1 through 3, load regulation is ±0.4% across the range from no load to full load. At output 4, the load is regulated ±4% over the same range. Pricing and delivery information for the supply was unavailable.

NCR Corp., 584 S. Lake Emma Rd., Lake Mary, Fla. 32746. Phone (305) 323-9250 [Circle 370]

400-W power supply fits into 325-W package

A compact switching power supply offers 400 W in the standard 325-W package, which is 2.37 by 15 by 4.87 in. The MS1167 has a half-bridge design and is recognized by Underwriters Laboratories 478 and the Canadian Standards Association 22.2 #154 for safety. Its single-output rating is +5 V at 80 A. Mean time before failure is estimated at 30,000 to 40,000 h under nominal line and full load at 40°C ambient temperature.

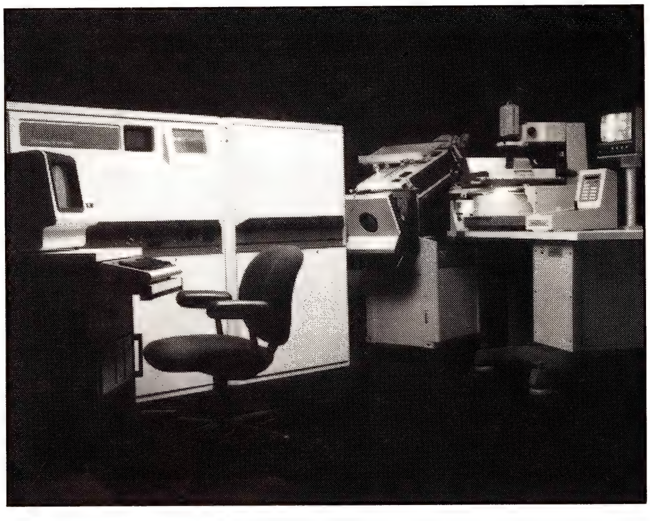


Single switchers sell for $382, $229 each in quantities of 1,000. Products are shipped in eight weeks.

Sierracin Corp., Power Systems Division, 20500 Plummer St., Chatsworth, Calif. 91311. Phone (818) 998-9873 [Circle 371]

Analog system tests mixed-signal gear

The A370 Analog LSI test system is designed to characterize and test mixed-signal gear that incorporates both analog and digital circuitry. The system's 18-bit computer uses Advanced Micro Devices' 2901C chip (based on



bit-slice technology) and supports up to 1 million words of main memory.

For flexibility in stimulating a device and analyzing its response, the system's high-speed digital module provides up to 40 drive/detect channels, each one independently programmable. The module also affords 18 programmable timing edges and can assign one of five drive formats.

A new release of the company's Pascal/Steps language offers editing, I/O, and debugging capabilities. Menu-based software packages with interactive-graphics allow development of digital-signal-processing test procedures. The A370 uses the firm's Vector Bus Architecture, which was introduced first in the earlier A360 testing system.

The A370 Analog LSI test system sells for $115,000 to $500,000. The typical unit costs $250,000 and includes the test computer, vector bus, array processor, digital module with 16 drive/detect channels, and software. Delivery takes eight weeks after receipt of order.

Teradyne Inc., 321 Harrison Ave., Boston, Mass., 02118.
Phone (617) 482-2700 [Circle 369]

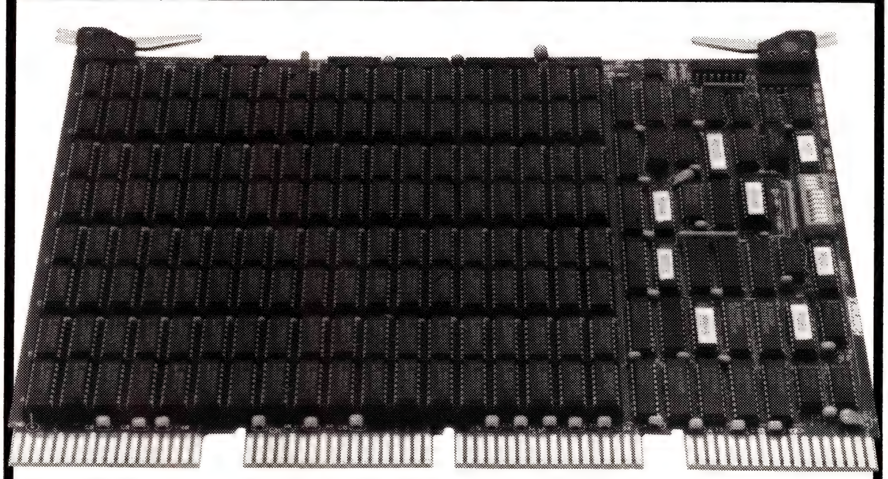
Infrared LED set suits photosensors, interruptors

A line of side-viewing infrared LEDs and phototransistors is suited for applications such as photosensors and interruptors. The model SIM-20ST emitter boasts a power output of 7 mW and, like the model RPM-20PB detector, measures 4.4 by 4.3 mm in a side-view package.

The SIM-20ST emits light at a peak wavelength of 950 nm, so it can be used with any silicon detector. It has a spectral bandwidth at 50% output points of 40 nm with a half-angle emission of 18°. Forward voltage is 1.25 V typical, with a 1.5-V maximum at 50 mA. The half-angle power spread of the RPM-20PB detector is 28° with a rise-and-fall time of 10 μs.

Collector-to-emitter breakdown is 32 V at 50 μA, and the dark current is a maximum of 0.5 μA at 10 V. The light current is 10 mA at 5 V. Maximum ratings for the emitter include a forward current of 50 mA,

KENTRONIX Q-BUS MEMORY SERVES YOU THE BEST!



MSV11-QX FEATURES
- User Expandable by Plugging 256KBit. RAM Chips in 512KB Increment Upto 4096KB.
- On-Board Control and Status Register.
- Block Mode DMA.
- Pre-Selected 256KBit RAM Used.
- 96Hour Burn-In.
- For All Q-Bus CPU and MICRO-VAX.
- Immediate Delivery.

KENTRONIX
Kentronix, Inc.
No.2 Nichidai Bldg. 1-6-14, Higashi-Nakajima,
Higashi-Yodogawa-Ku, Osaka 533, Japan
Phone:81-6-323-1707 Fax:81-6-323-1762
Telex:J64531 KENTRONX

Please Contact Kentronix for Your Nearest Distributor

Circle 75 on reader service card

For Space Reservations
Call: Production Department
(212) 512-3140

ElectronicsWeek
Special Report: April 8

Surface Mountable Components

Now that component placement machines and special soldering systems are available, only one roadblock still exists in the burgeoning SMD field—surface mountable components.

This Special Report will tell what's available, what's missing, what's coming in surface mountable resistors, capacitors, inductors, switches, relays, sockets, connectors and others.

It will include companies such as Philips SMD Technology Service Center, Allen Bradly, Kyocera, Amp, Burndy, Berg, Panasonic, TI, Moto, National Semi, Signetics, AVX, Murata Erie, Mepco-Electra, Rohm, Kemet, Sprague, Harris Semi and others.

Issue Date:
April 8, 1985

Closing for Advertising:
March 18, 1985

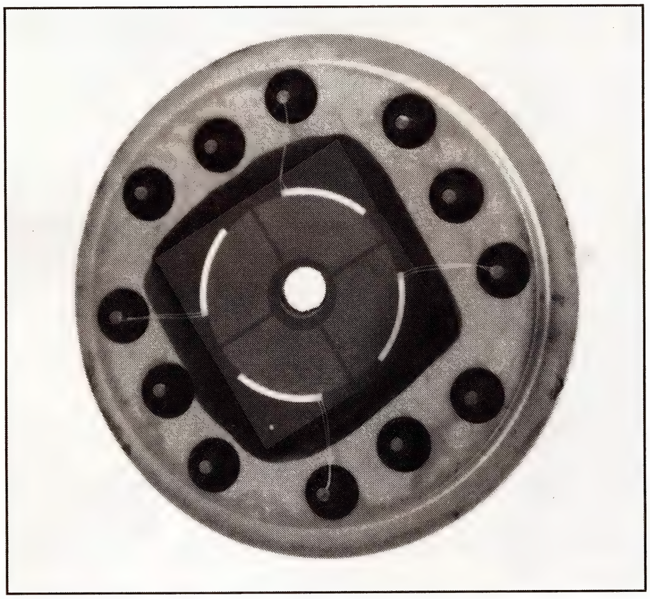
ElectronicsWeek
The Magazine of the Worldwide Electronics Industry

reverse voltage of 5 V, and power dissipation of 80 mW. Maximum ratings for the detector include a collector-to-emitter voltage of 30 V, emitter-to-collector voltage of 5 V, a light current of 30 mA, and power dissipation of 100 mW. Both parts sell for 35¢ each in quantities of 1,000. Deliveries take eight weeks and are from stock.

Rohm Corp., P.O. Box 19515, Irvine, Calif. 92713.
Phone (714) 855-2131 [Circle 378]

Four-quadrant photodiode fits process-control needs

Offered in a 12-pin TO-8 package, a four-quadrant silicon photodiode, the DS-11440, allows an optical fiber, LED, or other appropriate light source to be centered within the quadrants to permit directional back scattering or a variety of noncontact surface-inspection and process-control functions. The TO-8 package features a 0.050-in.-diameter hole through the silicon detector and TO-8 base. The large area (0.225 in. outside diameter) quadrant detector has a typical responsivity (at 900 nm) of 0.55 A/W, a capacitance of 20 pF at 10 V, and a dark current of 150 nA at 10 V.



Prototypes for evaluation sell for $450 each in lots of 1 to 10 pieces.

Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, Calif. 91320. Phone (805) 498-6737 [Circle 380]

Dual-port RAMs deal with data contention

Two CMOS dual-port static RAMs, the 16-K IDT 7132 and the 8-K IDT 7130, are said to replace up to 30 discrete parts with a single chip. Internal logic handles data contention when conflicts arise during simultaneous access of the same memory location. When both ports attempt to access the same memory location at the same time, on-chip arbitration logic determines which port has access. A chip-enable capability controls the chips' automatic power-down feature, which allows a port to enter the standby mode.

The chips are processed in compliance with MIL-STD-883, method 5004. Access times for the military-industrial versions are 100 ns and 120 ns; commercial access times are 90 ns and 100 ns.

The 16-K IDT 7132 sells for $324 for the 120-ns military version and $116 for the 100-ns commercial version in 100-plus quantities. The military and commercial versions of the 8-K IDT 7130 sell for $185 and $66, respectively. Packaging is either in a 48-pin DIP or 48-pin leadless chip carrier. Production shipments will begin during the middle of the second quarter.

Integrated Device Technology, 3236 Scott Blvd., Santa Clara, Calif. 95054. Phone (408) 727-6116 [Circle 341]

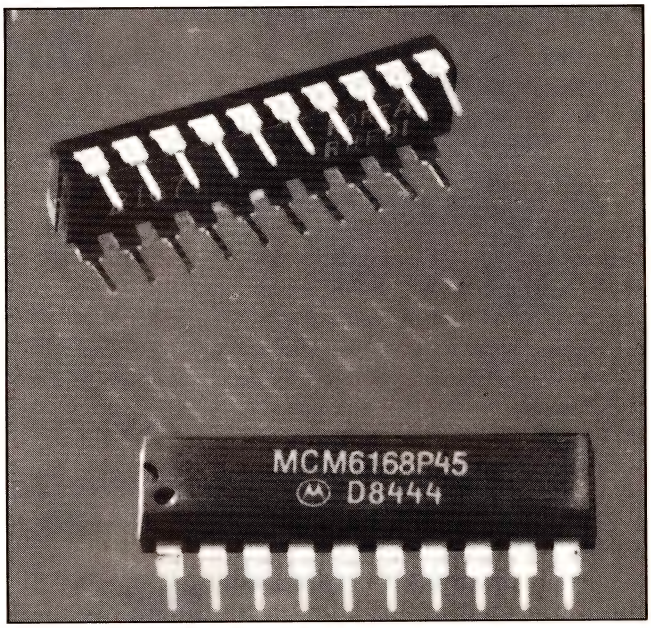
16-K static RAM uses firm's 68020 process technology

The first entry from this manufacturer in the 4-K-by-4-bit static-RAM market is fabricated in silicon-gate HCMOS III technology, on the same line as the MC68020 32-bit microprocessor. Available with 45-, 55-, or 70-ns access times, the MCM6168 incorporates advanced lithography and wafer-stepping expertise with 1.5-μm design-rules capability.

Operating from a single +5-V power supply, the static design eliminates the need for external clocks or timing strobes. System power is reduced without degrading access performance when chip enable goes high.

The MCM6168 comes in a 300-mil, 20-pin plastic DIP. Volume production will begin in March, and samples are available now. In quantities of 10,000, piece pricing is $8.25 for the 45-ns model, $6 for the 55-ns model, and $5.50 for the 70-ns version.

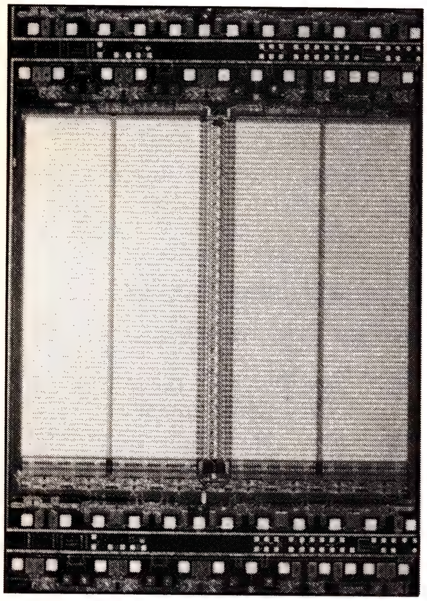
Motorola Inc., Memory Products Division, 3501 Ed Bluestein Blvd., Austin, Texas 78721. Phone (512) 928-7505 [Circle 342]



SOFTWARE

MIL-STD memories reach speed of 90 ns

Alpha-particle protection is featured in a line of 16-K CMOS static RAMs, available in commercial and MIL-STD-883C versions. The 21C16 series requires standby current of 0.5 μA and operates typically on 40 mA. These SRAMs are available with 45-, 55-, and 70-ns maximum speeds in the commercial-temperature range, and in 70- and 90-ns maximum speeds for use in the military-temperature range.

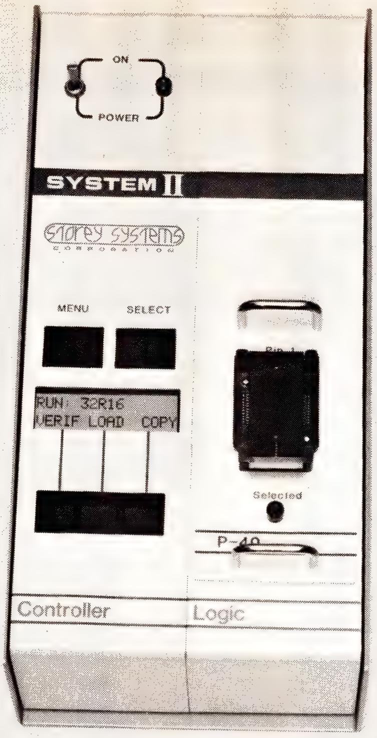


The 21C16 series of SRAMs has applications for cache memories used in high-speed minicomputers; high-end 32-bit microprocessors like the 68000 and the 80286; and very-high-speed data-communications buffers and telecommunications processors. The manufacturer will quote price and delivery times.

Solid State Scientific Inc., 3900 Welsh Rd., Willow Grove, Pa. 19090.
Phone (215) 657-8400 [Circle 340]

Expert-systems builder looks at varied problems

Playing the role of a knowledge engineer interviewing a human expert, Timm (The Intelligent Machine Model) is a computer program for building expert systems. Such systems have already been built for diagnosing diseases, selecting financial



Our
PAL*
Programmers
Cost
LESS

SYSTEM II MegaPAL Programmer
supports New 40 and 84 pin PALs by MMI.

Model P240 PAL Programmer
- supports all 20 and 24 pin PALs by MMI.
- Built-In PALASM Compiler
- Full Function Test Support
- Security Fuse Programming Support

STOREY SYSTEMS
CORPORATION
3201 North Hwy. 67 Suite E, Mesquite, Texas 75150 ● (214) 270-4135 ● Telex: 203941
*PAL, MegaPAL and PALASM are registered trademarks of Monolithic Memories, Inc.

Circle 77 on reader service card

COLCOAT 515
STOPS
Electrostatic Damage

Protect delicate LSI and IC chips from electrostatic damage with COLCOAT 515, a unique, alcohol-based liquid. One application of COLCOAT 515 on a chip carrier case prevents electrostatic buildup for more than two years. It dries quickly to form a tough, protective coating.

Japan's leading electronics makers use COLCOAT 515 because of the almost 100% perfect protection it affords. The incidence of rejection due to damage from static electricity is less than one in a million. Specify COLCOAT 515 to ensure the damage-free deliveries your customers want.

COLCOAT CO., LTD.
3-28-1 Omori-nishi, Ota-ku, Tokyo 143, Japan.
Phone: (03) 762-8526. Telex: 0246-7481 COLCOT J

Circle 96 on reader service card

ElectronicsWeek Special Report: April 8

For Space Reservations
Call: Production Department
(212) 512-3140

Surface Mountable Components

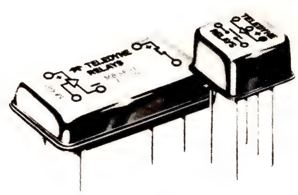
Now that component placement machines and special soldering systems are available, only one roadblock still exists in the burgeoning SMD field—surface mountable components.

This Special Report will tell what's available, what's missing, what's coming in surface mountable resistors, capacitors, inductors, switches, relays, sockets, connectors and others.

It will include companies such as Philips SMD Technology Service Center, Allen Bradly, Kyocera, Amp, Burndy, Berg, Panasonic, TI, Moto, National Semi, Signetics, AVX, Murata Erie, Mepco-Electra, Rohm, Kemet, Sprague, Harris Semi and others.

Issue Date:
April 8, 1985
Closing for Advertising:
March 18, 1985

ElectronicsWeek
The Magazine of the Worldwide Electronics Industry



HIGH SPEED POWER FET AC/DC HYBRID SWITCHING DEVICES

New M85F/M90F Power FET HSD's feature low on-resistance (0.3 ohms), no offset voltage, 1200V opto-isolation, hybrid microelectronic assembly to MIL-R-28750 & MIL-883, CMOS or TTL compatible, Schmitt trigger, 3.8 to 32V control voltage, 1.3A load, low EMI & high noise immunity. DC or AC units available at $38 ea. for 500 pcs. For fast low level switching, isolated line drivers, current loop switches, & servo control. **Teledyne Solid State Products,** 12525 Daphne Ave., Hawthorne, Ca. 90250, (213) 777-0077.

Circle 78 on reader service card

A guide to semiconductor strategies in the 80's!

CUSTOM & SEMICUSTOM VLSI: Survival Strategies For The New Era asks the question: Are you equipped to meet the challenges of an ever-changing industry? Radical change in industry can mean radical growth if you understand these changes.

Order this book today for an inside line on the challenges of change in the semiconductor market.

Send $150 or your company purchase order to:

R360

ElectronicsWeek Books
P.O. Box 541
Hightstown, NJ 08520

McGraw-Hill

strategies, locating mineral deposits, and tuning computer systems, to name a few possible applications.

Timm works independently of its domain—that is, it applies a general method, not tied to a particular problem, to construct and interpret the user's knowledge base. The program can deal with new or uncertain situations and arrive at best-guess answers for these situations. Timm will always make some kind of choice, even if the reliability is small.

Designed as a menu-and-prompt program, Timm communicates with the user in either "terse" or "verbose" style—the latter includes further explanations and definitions of terms. Through Timm, it is possible to link multiple expert systems into networks. The program requires no special-purpose hardware or software and is currently being implemented on IBM (including the Personal Computer), Amdahl, DEC, and Prime computers.

A single license for Timm-PC costs $9,500. Other licenses in varying quantities will be quoted by the manufacturer. Time-sharing is also available.

General Research Corp., Software Sales and Marketing, 7655 Old Springhouse Rd., McLean, Va. 22102.
Phone (703) 893-5900 [Circle 344]

Interactive program evaluates 8-bit RAMs

Teradyne's J386A and J386A-8 memory-test systems are extended by Visions-386, an interactive program for characterizing and evaluating RAMs up to 8 bits wide. Designed to speed time to market by shortening the characterization phase of the design cycle, Visions-386 combines test and hardware conditions.

Individual tests can be created using natural-language input, or they can be created off-line and then transferred to Visions-386. Test types include bit maps and data-logged results (called "shmoo plots"). The software also offers debugging tools.

Priced at $30,000, Visions-386 is available now.

Teradyne Inc., Inquiry Systems and Analysis, 660 Summer St., Building 114, Box 120, Boston, Mass. 02210 [Circle 345]

Dot-matrix printers become X-Y plotters

A machine-language extension to Applesoft Basic, Dotplot transforms the Imagewriter, Prowriter, Epson FX-80/RX-80 and a number of other dot-matrix printers into X-Y digital plotters. Dotplot creates a plotting window that can go as large as 2,048 by 32,000 dots, permitting the generation of high-resolution plots up to 12.8 in. wide by nearly 19 ft long. Plotting resolution is 72 dots/in. vertical and from 120 to 160 dots/in. horizontally, depending on the make of printer.

Dotplot, equipped with two X-Y data-plotting programs and a simple drafting program, sells for $65 and is available now.

CMI-Cascade Inc., P.O. Box 510, Philomath, Ore. 97370.
Phone (503) 929-6241 [Circle 346]

Compact laser marks metals and nonmetals

The YAG/180 marking system uses a laser to inscribe numbers, letters, logos, and bar-code symbols on a wide range of materials, both metal and nonmetal. The system has adjustable dot-matrix marking with overlap capabilities to provide a solid-character appearance. Within its 3¼-by-3½-in. field, the laser marks in five sizes between 1/16 in. and 11/64 in. with a depth of 0.003 in.

The combination of self-contained cooling system and dot-matrix technology minimizes the system's space requirements. The basic marking system sells for $43,000 and includes the laser, a controller, and a keyboard. A 24-by-24-by-34-in. enclosure for manual operations is available as well and sells for $5,500. In addition, the firm can customize the packaging for automatic feeding.

Other additions include an option that etches a heavier line, for $2,100; a small-character option, for $2,600; a RS-232-C interface, for $7,200; and a bar-code option that has yet to be priced. The company is currently taking orders.

Signode Corp., George T. Schmidt Division, 6250 W. Howard St., Chicago, Ill. 60648.
Phone (312) 967-6250 [Circle 381]

Divide and conquer.

COMMUNICATIONS SYSTEMS EQUIPMENT DESIGN
CHIP COMPRESSES DATA FOR IMAGE TRANSMISSION
ComputerSystems
EQUIPMENT DESIGN
TEAM DESIGNS AN AFFORDABLE SUPERCOMPUTER
INDUSTRIAL ELECTRONICS EQUIPMENT DESIGN
MICROCHIP GENERATES ALL TRIG FUNCTIONS ACCURATELY
MILITARY/SPACE ELECTRONICS DESIGN
HI-REL SEMICONDUCTOR QUALITY
IS RESCREENING NECESSARY?

The electronics industry has grown big and diverse. (It's now a $320 billion market.)

You can no longer be all things to all design engineers. This is why McGraw-Hill has introduced four new design magazines. Each targeted publication addresses the design need of a specific industry segment.

For example, when you advertise the military features of your components in "Military/Space Electronics Design" your message is more effective.

Using one of our four design publications cuts down waste circulation. Our rates are a fraction of the page rates of the design books that try to be all things to all designers.

Also, your ad doesn't get buried in a sea of other general design ads.

Instead of a bigger budget maybe you need a targeted budget. Multiply your market shares by dividing your budget into segments.

The *only* electronics directory you need…
1984-85 Electronics Buyers' Guide

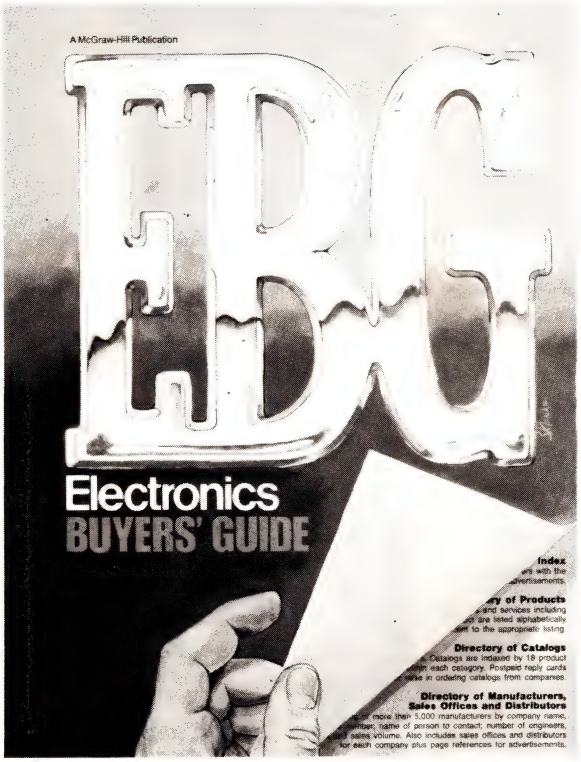
Now available: 1984-85 Electronics Buyers' Guide. Completely new listings of catalogs, new phone numbers, new addresses, new manufacturers, sales reps, and distributors! The total market in a book—**three** directories in one!

1.

Directory of products. Over 4,000 products, over 5,000 manufacturers.

2.

Directory of catalogs. Includes six post-paid catalog inquiry cards for 10-second ordering.


A McGraw-Hill Publication
EBG
Electronics
BUYERS' GUIDE
Index
Directory of Catalogs
Directory of Manufacturers, Sales Offices and Distributors

3.

Directory of manufacturers. Local sales offices, reps, and distributors, with phone numbers. Number of employees and engineers, dollar volume, name of company contact.

The only book of its kind in the field.

If you haven't got it, you're not in the market.

To insure prompt delivery enclose your check now.

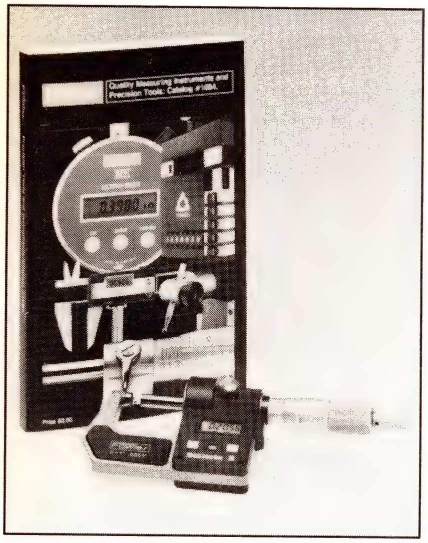
Write to:
Regina Hera
Electronics Buyers' Guide
1221 Avenue of the Americas
New York, New York 10020

Enclose check for:
- $40 for each copy delivered in U.S. and Canada.
- $50 for each copy delivered elsewhere. (Add $20 for air mail).

Make Check payable to: Electronics Buyers' Guide.

New Literature

System specs. AT&T Co.'s effort to promote a standard computing environment is detailed in "System V Interface Definition," a list of specifications that define a minimum set of system calls and library routines that should be common to all operating systems based on its Unix System V. The intent is to allow applications to execute on any system that conforms to the definition. Copies of the document may be ordered by calling (800) 432-6600, operator 77. The select code is 307127 and the price is $37. AT&T Information Systems, 100 Southgate Pkwy., Morristown, N.J. 07960. Phone (201) 898-8321. [Circle reader service number 421]



Precisely right. "Quality Measuring Instruments and Precision Tools" features digital instruments that can interface to a computer plus electronic measuring systems from Trimos and Sylvac. Ask for catalog 1684 from the Fred V. Fowler Co., Dept. L, P.O. Box 48, 66 Rowe St., Newton, Mass. 02166 or call (617) 332-7004. [Circle 422]

Deep reading. SRI International is distributing the second edition of its Research Publications Catalog. This problem-solving organization reports to clients on a wide range of subjects, which include *The Computer Chronicles* and reports on artificial intelligence, gallium arsenide semiconductors, microelectronics, and more. Free copies are available from SRI International, Marketing Services-201, 333 Ravenswood Ave., Menlo Park, Calif. 94025. Phone (415) 326-6200. [Circle 423]

Dig and discover. Seismographs, bore hole loggers, magnetometers, and airborne surveys are among the topics that are covered in EG&G Geometrics/EG&G Mount Sopris Instruments' latest catalog of geophysical equipment. Many of the software programs listed in the catalog are free, and applications and case histories appear throughout the publication. Request it by calling (408) 734-4616 or by writing to the company at 395 Java Dr., Sunnyvale, Calif. 94089. [Circle 426]

FCP
FREQUENCY CONTROL PRODUCTS, INC.
HI-TEMP
CMOS Crystal Clock Oscillators
100 MHz
CMOS HI-TEMP SERIES
Features:

Good vibes. CMOS crystal clock oscillators operating in temperature ranges to 200°C are covered in a free data sheet from Frequency Control Products Inc. It gives information on test and environmental data, specifications, and ordering information. Write the company at 61-20 Woodside Ave., Woodside, N.Y. 11377 or call (718) 458-5811. [Circle 427]

Liquid assets. Standard and custom liquid-crystal displays including guest-host dichroic, multiplex, and direct-drive (TNFE) displays are presented in this catalog, along with number of digits, display size, fluid type, and other specifications. A custom-design sheet is also offered by Hamlin Inc., Lake and Grove Sts., Lake Mills, Wis. 53551. Phone (414) 648-2361. [Circle 431]

Remote possibilities. RCA Corp.'s Distributor and Special Products Division has issued an updated catalog on RCA remote controls for video instruments (no. 1F5790 Rev. 1/85). It is available either from parts distributors or through the company's Sales Promotion Services, Deptford, N.J. 08096. [Circle 429]

Three of a kind. Cornell Dubilier distributes three free brochures—on mica capacitors, film capacitors, and ac capacitors—that give applications and specifications. Call (201) 256-2000 or write the Marketing Department, Wayne Interchange Plaza 1, Wayne, N.J. 07470. [Circle 425]

Back to back. Backplane circuit boards that meet MIL-C-55110 specifications with up to 20 layers are featured in "Backplane Interconnects and Bussing Systems," a free brochure available from Interconics. Obtain one by calling (612) 228-6512 or write to the company at 245 E. Sixth St., Third Floor, St. Paul, Minn. 55101. [Circle 428]

We mean business. The premier issue of *The Business Unix Journal* has hit the mails with articles on spreadsheets, an order entry and shipping system based on nroff, industry profiles, and software. An independent magazine, *Business Unix* is published from P.O. Box 1065, Lafayette, Calif. 94549; phone (415) 284-1610. An introductory subscription is $66 (regularly $74). [Circle 424]

POSITIONS VACANT

Gulf South Opportunities! Numerous open-ings in the Gulf Coast area for electronic engineers in the medical, computer and defense industries. All fees paid. For consideration send resume or call collect to Ann Jernigan, Snelling and Snelling, 428 Plaza Bldg., Pensacola FL 32505, (904) 434-1311.

Engineers — Discreet, Personal, Reputable. National-fee paid. Murkett Assoc., Box 527, Montgomery, AL 36101.

Electronics Technology — Arkansas' lar-gest community college is seeking an instructor to teach in a three-year electronics program leading to an advanced certificate in microprocessing technology. MSEE preferred; BSEE or related degree required with industrial experience considered. Liberal benefits available. Located in a growing, industrial community at the foot of the Ozark Mountains. Apply to: Office of Personnel, Westark Community College, P.O. Box 3649, Fort Smith, AR 72913. EOE.

Application Engineer needed in computer engineering consulting company. Require ME degree in Electrical Engineering. Experience with MC 68000 and disc controller. Experience in assemblers 6801, 6809, 6502, 68000, Z80 and experience in Apple II, MPF-I and MICE-II. Salary $30,000 per year. Contact Utah Job Service, 1234 South Main Street, Salt Lake City, UT. 84147 Job Order No. 76814.

POSITIONS WANTED

Electronics/R&D Engineer — Micro-processor based product design and assembly language programming. Project rates. Mr. Masel (718) 476-1516 (N.Y.)

HOT LINE

To place your

recruitment message

in

Electronics Week

call Pat Clyne
or Jim Corcoran
at

212/512-2983

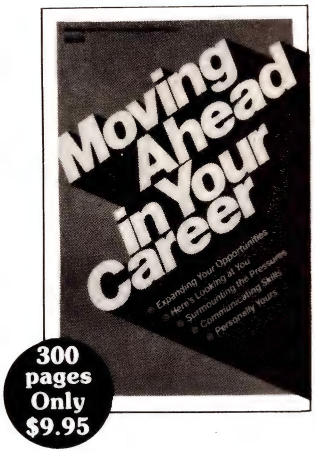
TO ANSWER BOX NUMBER ADS

Address separate envelopes (smaller than 11" x 5" for each reply to:

Box Number (As indicated)
Electronics Week
Box 900, NY 10020

Are you in your first engineering job?

Are you thinking about where you go from here?


Moving Ahead in Your Career
Expanding Your Opportunities
Here's Looking at You
Surmounting the Pressures
Communicating Skills
Personally Yours
300 pages Only $9.95

This book is a practical how-to-do-it guide from Graduating Engineer that you can put to use right now—articles like "How to Get a Good Performance Appraisal", "The Importance of a Mentor", "The Road to $50,000 a Year", "Winning at Office Politics"—and many more. Send for this book today and begin to move ahead in *your* career.

GRADUATING ENGINEER
P.O. Box 900
New York, NY 10020

Please send me ___ copies of "Moving Ahead in Your Career" at $9.95 each. Enclosed is my check/money order made out to Graduating Engineer for $______

Name

Address

City/State/Zip E

Advertise your software for only $114.75

For only $114.75 per inch you can advertise your software, designed specifically for the electronics industry, to a no-waste audience specifically in need of it—Electronics Week's paid circulation of 102,000 subscribers.

You'll waste no advertising dollars on waste circulation. These decision-makers need software applications designed specifically for their industry. That's why EWeek's Computer Software Section is a perfect interface because it is programmed to connect you with specific industry interests.

Send your copy/art to the address below. For more information, call David Emery at 212/512-2557.

Electronics Week Computer Software Section

Post Office Box 900
New York, NY 10020

1985 ELECTRONICS WEEK COMPUTER SOFTWARE SECTION

Sizes		Material
1 Inch	7/8 x 2 1/4	Artwork or
2 Inch	1 7/8 x 2 1/4	film preferred.
3 Inch	2 7/8 x 2 1/4	Typesetting
4 Inch	3 7/8 x 2 1/4	free of charge.

1985 RATES

Unit	1X	6X	12X
1 Inch	$114.75	$113.75	$112.80
2 Inch	229.50	227.50	225.60
3 Inch	344.25	341.25	338.40
4 Inch	459.00	455.00	451.20

Call David Emery 212/512-2557

An Alternative for Advertisers to Reach Design Engineers

COMMUNICATIONS SYSTEMS EQUIPMENT DESIGN

NEW!

Premier issue: October 1, 1984

Editorial:

Communications Systems Equipment Design is devoted entirely to international coverage of the communications segment of the electronics industry. It is produced by a team of experienced technical editors dedicated to providing readers with the most complete and accurate technical information available. A typical issue includes detailed technical articles focusing on significant trends or techniques authored by industry experts, provides in-depth technical articles and introduces new products.

Circulation:

25,000 qualified electronic design engineers specifically responsible for the design and manufacture of communicatrion equipment and systems, worldwide.

1985 Rates

	1x	12x	36x
1 page:	$2,050	$1,890	$1,810
2/3 page:	1,540	1,420	1,360
1/2 page:	1,270	1,175	1,120
1/3 page:	820	755	725
1/4 page:	655	605	580
1/6 page:	450	415	400

Cover rates	
2nd cover:	$2,850
3rd cover:	2,750
4th cover:	3,050

Color charges:	
Two color, standard:	$305
Matched 2nd color:	510
4 color process:	610
4 color process spread:	950

Issue and Closing Dates:

Issue Dates	Closing Dates
February 1, 1985	January 1, 1985
April 1, 1985	March 1, 1985
June 1, 1985	May 1, 1985
August 1, 1985	July 1, 1985
October 1, 1985	September 1, 1985
December 1, 1985	November 1, 1985

No Waste Circulation:

Communications Systems Equipment Design is a targeted and cost-efficient way to get your advertising read by communications equipment and systems design engineers, worldwide.

For space reservations, call Production Dept.,
McGraw-Hill Electronics Publications,
(212) 512-3140,
1221 Avenue of the Americas,
New York, N.Y. 10020.

Advertisers Index

	Advanced Micro Devices	26-27
	Agema	10-11
■	Amp Incorporated	42-43
‡	Carroll Touch	68
	Colcoat Co., Ltd.	77
	Data Precision	15
	Electronic Industry Show	37
‡	Fluke, John Mfg. Co.	65, 5
	General Electric	22-23
	General Electric Co.	4th C
	Harris Semiconductor	7
	Ironics	3
	Kentronix, Inc.	75
■	Keystone Electronics	71
‡	Livingston Development Corporation	58
*	Murata Manufacturing Co.	58
‡	NEC America Incorporated	8
■	Pearson Electronics	38
*	Philips T&M	8
	President Enterprises	73
	Rockwell International Semiconductor Division	1
*	Rohde & Schwarz	5
	SGS	12
	Sprague Electric	57
	Storey Systems	77
	Teledyne Crystalonics	9
■	Teledyne Relays	2nd C
	Teledyne Solid State	78
*	Telesoft	46
	Toshiba	3rd C
‡	Toshiba America, Inc.	66-67
■	U.S. Components, Inc.	71

Classified and employment advertising

Northern Telecom Inc.	71

■ For more information of complete product line see advertisement in the latest Electronics Buyers Guide
* Advertisers in International edition
‡ Advertisers in domestic edition

Advertising Sales Staff

Atlanta, Ga. 30319: Don Seay
4170 Ashford-Dunwoody Road N.E.
[404] 252-0626
Boston, Mass. 02116:
Joanna Henderson
575 Boylston St.
[617] 262-1160
Chicago, Ill. 60611
Betsy A. Otto [312] 751-3739
William J. Higgens III [312] 751-3738
645 North Michigan Avenue
Cleveland, Ohio 44113: Joe Milroy
[215] 496-3800
Costa Mesa, Calif. 92626: Debbie Smith
3001 Red Hill Ave. Bldg. #1 Suite 222
[714] 557-6292

Dallas, Texas 75240: Harry B. Doyle, Jr.
5151 Belt Line Road, Suite 907
[214] 458-2400
Englewood, Co. 80112: Harry B. Doyle, Jr.
7400 South Alton Court Suite 111
[303] 740-4633
Houston, Texas 77040: Harry B. Doyle, Jr.
7600 West Tidwell, Suite 500
[713] 462-0757
Los Angeles, Calif. 90010: Chuck Crowe
3333 Wilshire Blvd.
[213] 480-5210
New York, N.Y. 10020
Matthew T. Reseska [212] 512-3617
Albert J. Liedel [212] 512-3616
1221 Avenue of the Americas
Palo Alto, Calif. 94303:
Larry Goldstein, Lauren Scott, Lynne Simonfy
1000 Elwell Court, [415] 968-0280
Philadelphia, Pa. 19102: Joseph Milroy
Three Parkway, [215] 496-3800
Pittsburgh, Pa. 15222: Joseph Milroy
Suite 215, 6 Gateway Center, [215] 496-3800
Southfield, Michigan 48075: Betsy A. Otto
4000 Town Center, Suite 770, Tower 2
[313] 352-9760
San Francisco, Calif. 94111:
Larry Goldstein, Lauren Scott, Lynne Simonfy
425 Battery Street
[415] 362-4600

Brussels: Art Scheffer
23 Chaussee de Wavre
Brussels 1040, Belgium
Tel: 513-73-95
Frankfurt/Main: Fritz Krusebecker, Dieter Rothenbach
19 Liebigstrasse, Germany
Tel: 72-01-81
Milan: Savio Pesavento
1 via Baracchini, Italy
Tel: 86-90-656
Paris: Jean - Christian Acis
17 Rue-Georges Bizet, 75116 Paris, France
Tel: 720-33-42
Scandinavia: Andrew Karnig
Finnbodavagen
S-131 31 Nacka
Sweden
Tel. 46-8-440005
Telex: 17951 AKA S
Tokyo: Akio Saijo
McGraw-Hill Publications Overseas Corporation,
Kasumigaseki Building 2-5, 3-chome,
Kasumigaseki, Chiyoda-Ku, Tokyo, Japan
[581] 9811

United Kingdom: Art Scheffer
34 Dover Street, London W1
Tel: 01-493-1451

Business Department

Frederick J. Kostbar
Business Manager/Controller
[212] 512-2627
Leon Irgang
Circulation Director
[609] 426-5542
Archie Anderson
Director of Marketing Services
[212] 512-6642
Frances M. Vallone
Reader Service Manager
[212] 512-6058
Thomas M. Egan
Production Director
[212] 512-3140
Carol Gallagher
Production Manager
[212] 512-2045
Betty Preis
Production Manager
[212] 512-2908
Amy M. Ziebarth
Production Assistant
212 512-2843

Classified and Employment Advertising

[212] 512-2556

LOCK UP THE LAB— HERE COMES CONGRESS

Engineers know that the wellspring of technology—what is known as pure research or science—can be nurtured only in an atmosphere as free of restriction as possible.

That is why we view with alarm the new excursion of the government into the preserve, under the cover of a study by the House Science and Technology Committee whose objective is to better regulate the expenditure of tax money. The study group, consisting of 18 committee members, offers this ringing rationale for its work: "The payoff from science has always been surrounded by a certain degree of rhetorical vagueness."

The first impulse is to laugh hysterically at the thought of members of the U.S. Congress waxing stern about rhetorical vagueness; the second is to change the locks on the laboratory doors.

One aspect of the study is particularly interesting. The members mean to take a look at the concept of peer review, in which panels of scientists examine applications for federal grants and rank them. While they're at it, they might also examine a shabby, if not dishonest, practice that has become popular in the last few years among *their* peers seeking to circumvent the review process for politcal gain. They simply attach riders to other legislation appropriating money for projects favoring universities in the home district. It must be admitted that scientific peer review, flawed though it may be, certainly is a more reliable system than political opportunism.

Although it is possible that some good can come of the study group's work, the long-range ramifications are most worrisome and dangerous. The temptation for politicians to seek the cheap headline by spotlighting the occasional horror story might prove irresistible. It is too much to hope that these investigators will learn the most basic truth of all: scientific research must be free to make mistakes.

SHOULD THE FCC LAB SIT ON ITS PROBLEM?

While we're on the subject of the tax dollar, consider the story out of Washington in the Feb. 11 issue (p. 28) about the hard times that the Federal Communications Commission's laboratory is going through. It seems that the lab, as Karen Berney reported, has requested $70,000 for fiscal 1986—that is what one new spectrum analyzer would cost—yet might wind up with a mere $5,000. This would particularly hurt the work that the lab does in evaluating the interference potential of new modulation techniques.

Now $70,000 isn't even lunch money in these heady days when a trillion-dollar budget seems just around the corner. And $5,000? That's not an appropriation, that's an insult. But we have a plan that we believe will not only satisfy those profligate spenders at the FCC lab but should also bring tears of gratitude to the eyes of the administration's budget cutters. How about giving the lab some of those $700 Navy toilet seats? Then the lab could hold a benefit auction. Bet it would raise more than $5,000.

There's Room in One LCD Module for the Entire Globe.

–It Displays 2,000 Characters on a Large Screen–

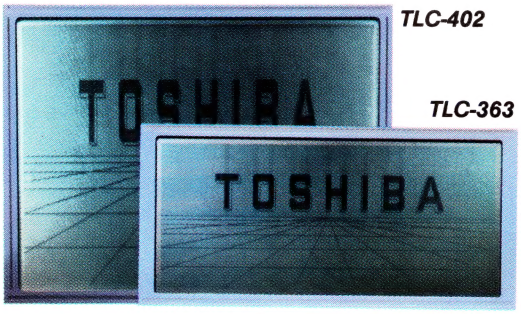
Simulated picture

New LCD modules from TOSHIBA give you 640 × 200 dot displays plus your choice of display area: virtually the size of an ordinary magazine or half that size.

The large display area puts a lot of information on view – either module can give you an array of 80 characters × 25 lines. Yet TOSHIBA technology cuts bulk and power consumption to the bone. These slim LCD modules are battery-powered, and they are compatible with current CRT displays without changing software.

All these features add up to portability. Versatility. Usability. These LCD modules are ideal as displays for portable word processors, personal computers, POS terminals and other display terminals.

Ask us. TOSHIBA is there when it comes to the technology you need in LCD components.



TLC-402

TLC-363

Specifications

		TLC-402	TLC-363
Display			
Number of Characters		80×25 (2,000 characters)	80×25 (2,000 characters)
Dot Format		8×8, alpha-numeric	8×8, alpha-numeric
Overall Dimensions (W×H×D)		274.8×240.6×15.0 mm	275.0×126.0×15.0 mm
Maximum Ratings			
Storage Temperature		–20 – 70°C	–20 – 70°C
Operating Temperature		0 – 50°C	0 – 50°C
Supply Voltage	V_{DD}	7 V	7 V
	V_{DD}-V_{EE}	18 V	18 V
Input Voltage		$0 \leq V_{IN} \leq V_{DD}$	$V_{SS} \leq V_{IN} \leq V_{DD}$
Recommended Operating Conditions			
Supply Voltage	V_{DD}	5 ±0.25 V	5 ±0.25 V
	V_{EE}	–13 V Max.	–13 V Max.
Input Voltage	High	4.0 V Min.	4.0 V Min.
	Low	0.5 V Max.	0.5 V Max.
Typical Characteristics (25°C)			
Response Time	Turn ON	300 ms	300 ms
	Turn OFF	300 ms	300 ms
Contrast Ratio		5	5
Viewing Angle		15 – 35 degrees	15 – 35 degrees

Design and specifications are subject to change without notice.

TOSHIBA

Toshiba America, Inc.: Electronic Components Div., 2692 Dow Avenue, Tustin, CA 92680, U.S.A. Tel: (714) 832-6300
Toshiba Europa (I.E.) GmbH: Electronic Components Div., Hammer Landstrasse 115, 4040 Neuss 1, F.R. Germany Tel: (02101) 1580
Toshiba (UK) Ltd.: Electronic Components Div., Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU 165JJ, England Tel: 0276 62222
Toshiba Electronics Scandinavia AB: Vasagatan 3, 6th Floor, S-111 20 Stockholm, Sweden Tel: 08-14 56 00

GE PERIPHERALS. ONE BRAND FITS ALL.

General Electric, one of the strongest names in electronics, introduces "the quality connection"—a series of high quality peripherals designed to work with major brands of home computers. This complete line includes products designed to extend the versatility of most home computer systems.

Model 13BC5509X
13" Color Monitor/TV

Model 3-8100
Letter Quality Printer

Model 3-8200
Modem

Model 3-5156
Data Recorder

COMPATIBILITY.

Since GE's peripherals are compatible with most home computers, you don't have to carry a variety of brands to match your computer lines. We designed Interfaces for use with various Atari® and Commodore® home computers as well as the IBM® PCjr. Compatibility means profitability and broader consumer appeal.

FULL LINE VALUE.

GE peripherals provide value by offering features and benefits consumers want. Like the letter quality Printer with graphics capabilities. Color and monochrome Monitors that double as high performance televisions. A Modem that has both acoustic and direct connection to telephone systems, and a Data Recorder that's omni-compatible. All designed to fit home computer needs tomorrow as well as today.

QUALITY THAT WON'T QUIT.

GE peripherals are built to last. For instance, the Printer has been designed for over 20 million impressions and run for over one thousand, five hundred hours.

The Modem has been subjected to rigorous drop testing and the Data Recorder has been designed for day in, day out rugged use. This is why we can offer full two-year warranties on the Printer and Modem, and a full one-year warranty on the Data Recorder.

In addition, the GE Answer Center™ is always available to assist you or your customers 24 hours a day.

FOR MORE INFORMATION:

Contact your GE sales representative or call the new GE Business Information Center at (518) 438-6500 for more information on "The Quality Connection"

We bring good things to life.

A TRADEMARK OF THE GENERAL ELECTRIC CO.

*Atari is a registered trademark of Atari, Inc.
*IBM is a registered trademark of International Business Machines Corporation.
*Commodore is a registered trademark of Commodore Electronics, Ltd.

Circle 902 on reader service card